

Transistor

PREMIUM TYPE

GERMANIUM P-N-P ALLOY-JUNCTION TYPE

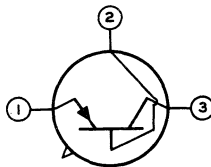
For Critical Computer Switching Applications

GENERAL DATA

Mechanical:

Operating Position	Any
Maximum Length (Excluding flexible leads)	0.260"
Maximum Diameter	0.370"
Dimensional Outline	JEDEC No. TO-5
Case	Welded, Metal
Seals	Hermetic
Leads, Flexible	3
Minimum length	1.5"
Orientation and diameter	See <i>Dimensional Outline</i>
Terminal Diagram:	BOTTOM VIEW

Lead 1—Emitter
Lead 2—Base



Lead 3—Collector

SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Maximum Values:

COLLECTOR-TO-BASE VOLTAGE	-25 max.	volts
COLLECTOR-TO-EMITTER VOLTAGE:		
With dc emitter-to-base volts = -1.	-24 max.	volts
EMITTER-TO-BASE VOLTAGE	-12 max.	volts
COLLECTOR CURRENT	-200 max.	ma
EMITTER CURRENT	200 max.	ma
TRANSISTOR DISSIPATION: ^a		
At ambient temperature of 25° C	150 max.	mw
At ambient temperature of 55° C	75 max.	mw
At ambient temperature of 71° C	35 max.	mw
AMBIENT-TEMPERATURE RANGE:		
Operating	-65 to +85	°C
Storage	-65 to +100	°C
LEAD TEMPERATURE:		
For 10 seconds maximum	235 max.	°C

^a See accompanying Rating Chart.

3907/2N404

ELECTRICAL CHARACTERISTICS

Voltage values are given with respect to base and ambient temperature of 25° C unless otherwise specified

Min. Typical Max.

DC Collector Breakdown				
Voltage for dc collector $\mu\alpha = -20$, dc emitter current = 0 .BV _{CBO}	-25	-45	-	volts
DC Emitter Breakdown				
Voltage for dc emitter $\mu\alpha = -20$, dc collector current = 0 .BV _{EBO}	-12	-30	-	volts
DC Emitter Floating				
Potential for dc collector volts = -25, dc emitter current = 0V _{EBF}	-	-	-1	volt
DC Base-to-Emitter				
Saturation Voltage: V _{BE(sat)}				
With dc collector				
ma. = -12, dc base				
ma. = -0.4	-	-0.3	-0.35	volt
With dc collector				
ma. = -24, dc base				
ma. = -1	-	-0.32	-0.4	volt
DC Collector-to-Emitter				
Saturation Voltage: V _{CE(sat)}				
With dc collector				
ma. = -12, dc base				
ma. = -0.4	-	-0.1	-0.15	volt
With dc collector				
ma. = -24, dc base				
ma. = -1	-	-0.12	-0.2	volt
DC Collector-Cutoff				
Current for dc collector volts = -12, dc emitter current = 0, ambient temperature of:				
25° C	-	-2	-5	$\mu\alpha$
80° C	-	-45	-90	$\mu\alpha$
DC Emitter Cutoff Current for emitter volts = -2.5, dc collector current = 0 .I _{EBO}	-	-1	-2.5	$\mu\alpha$
DC Current Transfer				
Ratio: h _{FE}				
For dc collector-to-emitter volts = -0.15, dc collector				
ma. = -12	30	45	-	
For dc collector-to-emitter volts = -0.2, dc collector				
ma. = -24	24	40	-	



Power Transistor

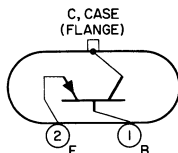
GERMANIUM P-N-P ALLOY TYPE

For Class A and Push-Pull Class B Service in High-Fidelity
Audio-Frequency Power-Amplifier Applications

MECHANICAL

Dimensions See Outline TO-3 in General Section
Pin Length 0.440 min—0.480 max in
Maximum Mounting-flange Thickness. 0.050 in
TERMINAL DIAGRAM (Bottom View)

Pin 1—Base
Pin 2—Emitter



Mounting Flange—
Collector,
Case

ABSOLUTE-MAXIMUM RATINGS

Collector-to-Base Voltage.	V _{CB0}	-32	V	
Collector-to-Emitter Voltage	V _{CER}	-32	V	
R _{BE} ≤ 33 Ω				
Emitter-to-Base Voltage.	V _{EB0}	-5	V	←
Collector Current.	I _C	-5	A	
Base Current	I _B	-1	A	
Transistor Dissipation				
At mounting-flange temperatures: ^a				
From -65 to 81 °C.	P _T	12.5	W	
Above 81 °C.	Derate linearly 0.66 W/°C			
Temperature Range				
Operating (Junction)	T(opr)	-65 to 100	°C	
Storage.	T(stg)	-65 to 100	°C	
Pin-Soldering Temperature ^b				
For 10 s max.		255	°C	←

ELECTRICAL CHARACTERISTICS

Electrode-voltage and electrode-current values for given test
conditions are dc at mounting-flange temperature = 25 °C

		Min	Typ	Max	
Collector-to-Base Breakdown Voltage	BV_{CB0}	-32	-	-	V
$I_C = -0.005 \text{ A}, I_E = 0$					
Collector-to-Emitter Breakdown Voltage.	BV_{CER}	-32	-	-	V
$I_C = -0.2 \text{ A}, R_{BE} = 33 \Omega$					
Emitter-to-Base Breakdown Voltage	BV_{EB0}	-5	-	-	V
$I_E = -0.002 \text{ A}, I_C = 0$					
Base-to-Emitter Voltage	V_{BE}	-	-0.18	-	V
$V_{CB} = -10 \text{ V}, I_C = -0.05 \text{ A}$					

← Indicates a change.



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DATA 1
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Collector-Cutoff Current . . .	I_{CBO}	Min	Typ	Max	mA
$V_{CB} = -30 \text{ V}$, $I_E = 0$		-	-	-1	
Collector-Cutoff Saturation Current	$I_{CBO}(\text{sat})$	-	-	-0.1	mA
$V_{CB} = -0.5 \text{ V}$, $I_E = 0$					
DC Forward-Current Transfer Ratio	h_{FE}	38	70	-	
$V_{CE} = -2 \text{ V}$, $I_C = -1 \text{ A}$					
Gain-Bandwidth Product	f_T	-	300	-	kc/s
$V_{CE} = -5 \text{ V}$, $I_C = -0.5 \text{ A}$					
Thermal Resistance	θ_{JC}	-	-	1.5	$^{\circ}\text{C/W}$
Junction-to-case					

TYPICAL OPERATION

In class A AF-amplifier circuit at mounting-flange temperature = 25 $^{\circ}\text{C}$

DC Collector Supply Voltage (V_{CC})	-16	V
DC Collector-to-Emitter Voltage	-13.2	V
DC Collector Current	-0.9	A
Peak Collector Current	-1.8	A
Input Impedance	15	Ω
Collector Load Impedance	15	Ω
Maximum Collector Dissipation	12	W
→ Power Gain	36	dB
Total Harmonic Distortion	5	%
Maximum-Signal Power Output	5	W

In accompanying "single-ended push-pull" class B AF-amplifier circuit at mounting-flange temperature = 25 $^{\circ}\text{C}$

Unless otherwise specified, values are for 2 transistors

DC Collector Supply Voltage (V_{CC}) ^c	-14	V
Zero-Signal Base-Bias Voltage	-0.18	V
Zero-Signal DC Collector Current	-0.05	A
Maximum-Signal DC Collector Current	-0.716	A
Peak Collector Current	-2.25	A
Input Impedance of Stage (Per base)	60	Ω
Load Impedance (Speaker voice-coil)	4	Ω
Maximum Collector Dissipation (Per transistor under worst-case conditions)	5	W
Music Power Output ^d	18	W
→ Power Gain	25	dB
Total Harmonic Distortion	5	%
Maximum-Signal Power Output	10	W

^a Measured at center of seating plane.

^b Measured along pin at distances equal to or greater than 1/32 inch from seating surface.

^c The data shown are for a dc collector supply having 10 per cent regulation.

^d Determined according to EIA Standard RS234, Section 2.1.2.1.

→ Indicates a change.



OPERATING CONSIDERATIONS

Because the metal case of this transistor operates at the collector voltage, consideration should be given to the possibility of shock hazard if the case is to operate at a voltage appreciably above or below ground potential, therefore, suitable precautionary measures should be taken.

This transistor can be installed in a commercially available socket. Electrical connection to the base and emitter pins may also be made by soldering directly to the pins. Such connections may be soldered to the pins provided care is taken to conduct excessive heat away from the seals. Otherwise the heat of the soldering operation will crack the pin seals and damage the transistor.

It is essential that the mounting flange which serves as the collector terminal be securely fastened to a heat sink, which may be the equipment chassis. *Under no circumstances, however, should the mounting flange be soldered to the heat sink or chassis because the heat of the soldering operation will permanently damage the transistor.*

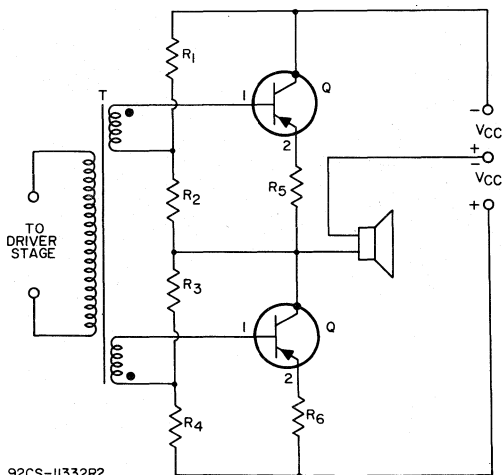
The mounting-flange temperature of this transistor will be higher than the ambient (free-air) temperature by an amount which depends on the heat sink used. The heat sink must have sufficient thermal capacity to assure that the heat dissipated in the heat sink itself does not raise the transistor-mounting-flange temperature above the design value.

Depending on the application, the heat sink or chassis may be connected to either the positive or negative terminal of the voltage supply.

In applications where the chassis is connected to the positive terminal of the voltage supply, it will be necessary to use an anodized-aluminum washer having high thermal conductivity, or a 0.002" thick mica insulator between the mounting flange and the chassis. If an aluminum washer is used, it should be drilled or punched to provide the two mounting holes and the clearance holes for the emitter and base pins. The burrs should then be removed from the washer and the washer finally anodized. To insure that the anodized insulating layer is not destroyed during mounting, it will also be necessary to remove the burrs from the holes in the chassis. Furthermore, to prevent a short circuit between the mounting bolts and the chassis, it is important that a fiber washer be used between each bolt and the chassis. See *Suggested Mounting Arrangement*.



"SINGLE-ENDED PUSH-PULL" CLASS B
AF AMPLIFIER-STAGE CIRCUIT



92CS-11332R2

Q: Transistor Type 40022

R_1, R_3 : 270 ohms $\pm$ 10%, 1 watt

R_2, R_4 : 3.9 ohms $\pm$ 10%, 0.5 watt

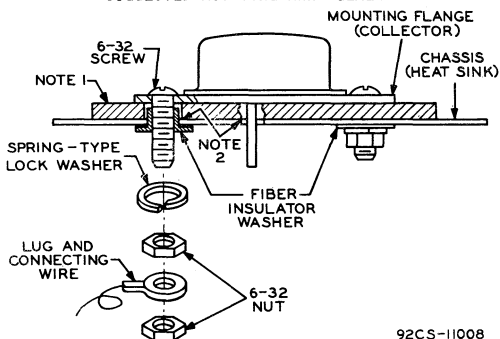
R_5, R_6 : 0.51 ohm $\pm$ 10%, 0.5 watt

T: Driver Transformer. Primary-winding impedance, current-carrying capacity, and dc resistance determined by large-signal characteristics of driver stage; secondary windings bifilar wound, impedance of each winding = 100 ohms.

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SUGGESTED MOUNTING ARRANGEMENT

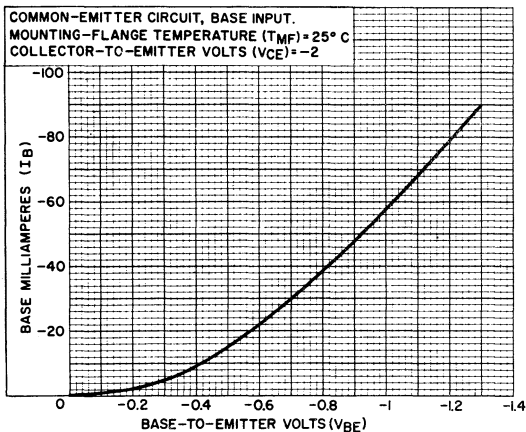


92CS-11008

Note 1: 0.002" mica insulator or anodized aluminum insulator (drilled or punched with burrs removed).

Note 2: Remove burrs from chassis holes.

Typical Input Characteristic



92CS-12179RI

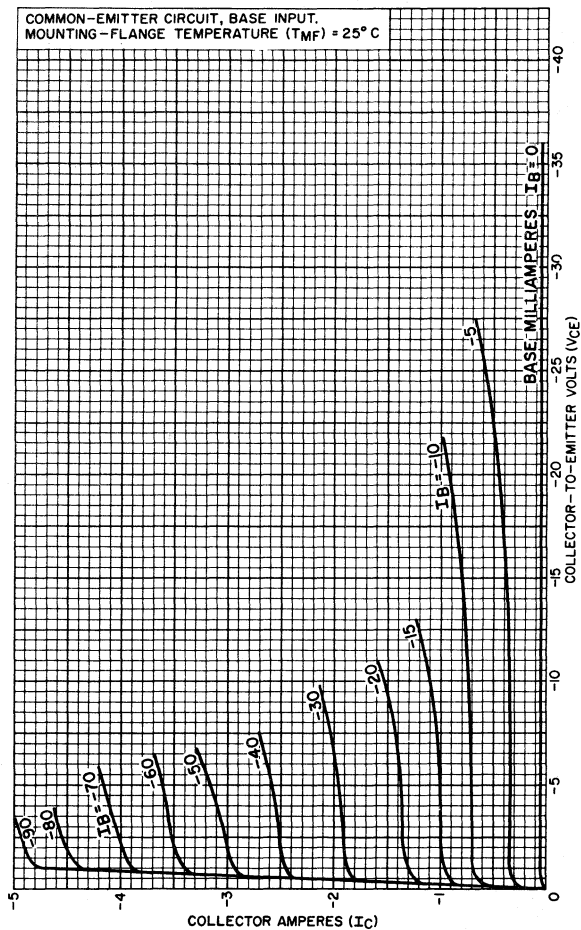


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DATA 3
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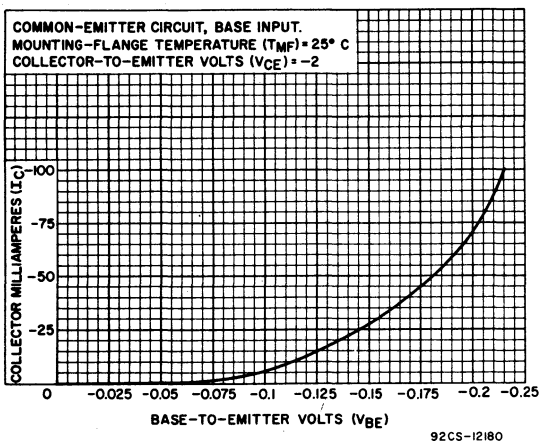
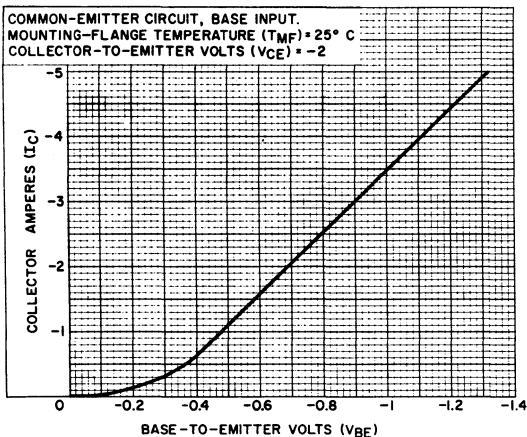
Typical Collector Characteristics



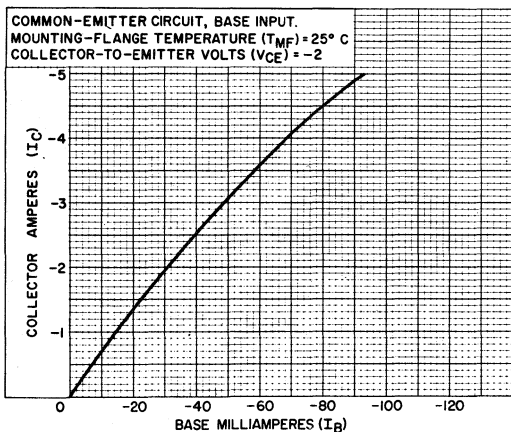
92CM-12177R1



Typical Transfer Characteristics



Typical Current-Transfer Characteristic



92CS-12181R1



Power Transistor

GERMANIUM P-N-P ALLOY TYPE

For High-Fidelity- and other Commercial-Audio-Frequency Amplifier Applications. In Push-Pull Class B Service, delivers up to 15 watts.

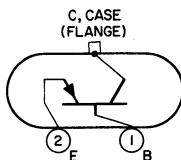
Mechanical:

Dimensions. See Outline TO-3 in General Section
 Pin Length. 0.440" — 0.480"
 Maximum Mounting-flange Thickness. 0.050"

Terminal Diagram

BOTTOM VIEW

Pin 1—Base
 Pin 2—Emitter



MOUNTING FLANGE—
 Collector,
 Case

AUDIO-FREQUENCY POWER AMPLIFIER SERVICE

Maximum Ratings, Absolute-Maximum Values:

Collector-to-Base Voltage.	V_{CBO}	-40 max.	volts
With emitter open			
Collector-to-Emitter Voltage . . .	V_{CEO}	-40 max.	volts
With base open			
Emitter-to-Base Voltage.	V_{EBO}	-5 max.	volts
With collector open			
Collector Current.	I_C	-5 max.	amp
Base Current	I_B	-1 max.	amp

Transistor Dissipation

Average:

At mounting-flange
 temperatures^a

From -65° to 81° C P_T 12.5 max. watts

Above 81° C. Derate linearly 0.66 watt/°C

Peak:

Determined by operating

conditions See Collector Characteristics Curves

Temperature

Operating range (Junction) T_{opr} -65 to 100 °C

Storage range. T_{stg} -65 to 100 °C

Pins^b (During soldering):

For 10 seconds maximum T_p 255 max. °C



ELECTRICAL CHARACTERISTICS

Mounting-flange temperature^a = 25° C

Min. Typ. Max.

DC Collector-to-Base Breakdown Voltage.	BV_{CBO}	-40	-	-	volts
$I_C = -5$ ma., $I_E = 0$					
DC Collector-to-Emitter Breakdown Voltage.	BV_{CER}	-40	-	-	volts
$I_C = -600$ ma., $R_{BE} = 68$ ohms					
DC Emitter-to-Base Breakdown Voltage.	BV_{EBO}	-5	-	-	volts
$I_E = -2$ ma., $I_C = 0$					
DC Base-to-Emitter Voltage.	V_{BE}	-	0.17	-	volt
$V_{CB} = 10$ volts, $I_C = -0.05$ ampere					
DC Collector-Cutoff Current.	I_{CBO}	-	-	-500	μ a
$V_{CB} = -30$ volts, $I_E = 0$					
DC Collector-Cutoff Saturation Current.	$I_{CBO(sat)}$	-	-	-100	μ a
$V_{CB} = -0.5$ volt, $I_E = 0$					
DC Forward-Current Transfer Ratio.	h_{FE}	50	90	-	
$V_{CE} = -2$ volts, $I_C = -1$ ampere					
Gain-Bandwidth Product.	f_T	-	500	-	kc
$V_{CE} = -5$ volts, $I_C = -0.5$ ampere					
Thermal Resistance.	θ_{JMF}	-	-	1.5	°C/watt
Junction-to-mounting-flange					

TYPICAL OPERATION

In class A AF-amplifier circuit at mounting-flange temperature^a of 25° C

DC Collector Supply Voltage (V_{CC}).	-16	volts
DC Collector-to-Emitter Voltage.	-13.2	volts
DC Collector Current.	-0.9	amp
Peak Collector Current.	-1.8	amp
Input Impedance.	10	ohms
Collector Load Impedance.	15	ohms
Maximum Collector Dissipation.	12	watts
Power Gain.	36	db
Total Harmonic Distortion.	5	%
Maximum-Signal Power Output.	5	watts

In accompanying "single-ended push-pull" class B AF-amplifier circuit at mounting-flange temperature^a of 25° C.

Unless otherwise specified, values are for 2 transistors.

DC Collector Supply Voltage (V_{CC}) ^c	-18	volts
Zero-Signal Base-Bias Voltage	-0.17	volt
Zero-Signal DC Collector Current	-0.05	amp
Maximum-Signal DC Collector Current	-0.8	amp
Peak Collector Current	-2.8	amp
Input Impedance of Stage (Per base)	32	ohms
Load Impedance (Speaker voice-coil)	4	ohms
Maximum Collector Dissipation (Per transistor under worst-case conditions).	7.5	watts
Power Gain.	28	db
Total Harmonic Distortion	5	%
Music Power Output ^d	25	watts
Maximum-Signal Power Output	15	watts

^a Measured at center of seating plane.

^b Measured along pin at distances not less than 1/16" down from seating plane.

^c The data shown are for a dc collector supply having 10 per cent regulation.

^d Determined according to EIA Standard RS234, Section 2.1.2.1.

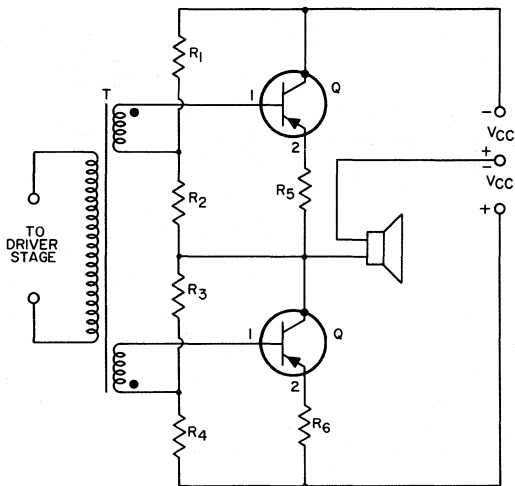
OPERATING CONSIDERATIONS

It is important that the mounting flange which serves as the collector terminal be securely fastened to a heat sink.

It is to be noted that the case of this transistor operates at the collector voltage. Because of the possibility of shock hazard, when the case of this transistor is at a voltage appreciably above or below ground potential, suitable precautionary measures should be taken.



"SINGLE-ENDED PUSH-PULL" CLASS B AF AMPLIFIER-STAGE CIRCUIT



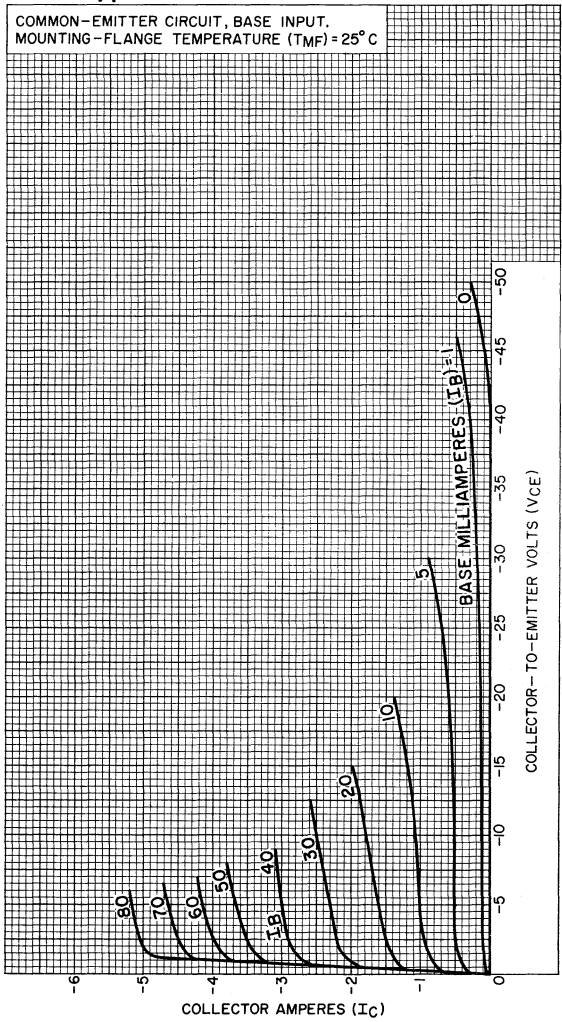
92CS-11332R2

- Q: Transistor type 40050
 R_1, R_3 : 390 ohms $\pm 10\%$, 1 watt
 R_2, R_4 : 3.9 ohms $\pm 10\%$, 0.5 watt
 R_5, R_6 : 0.33 ohm $\pm 10\%$, 0.5 watt
 Speaker: Voice-Coil Impedance . . 4 ohms

T: Driver Transformer, Primary-winding impedance, current-carrying capacity, and dc resistance determined by large-signal characteristics of driver stage; secondary windings bifilar wound, impedance of each winding = 100 ohms.

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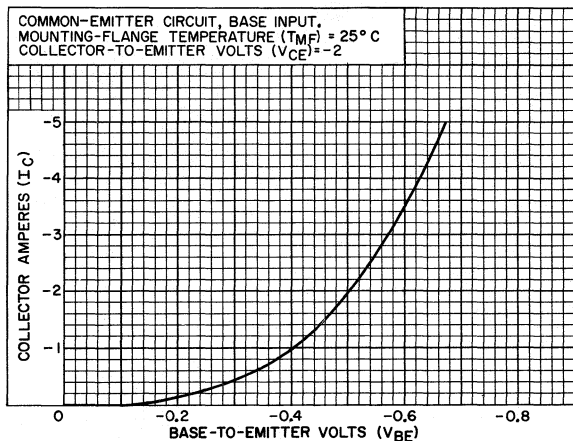
Typical Collector Characteristics



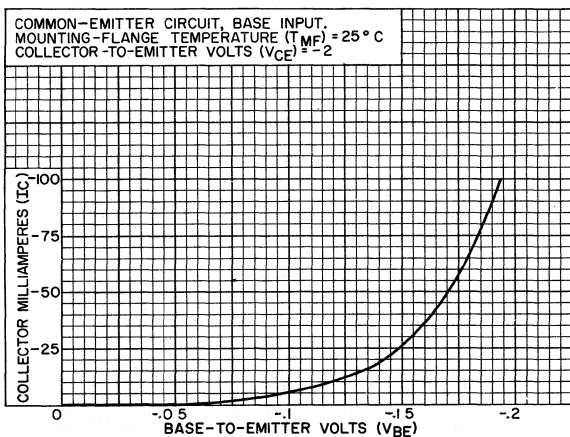
92CM-12466



Typical Transfer Characteristics



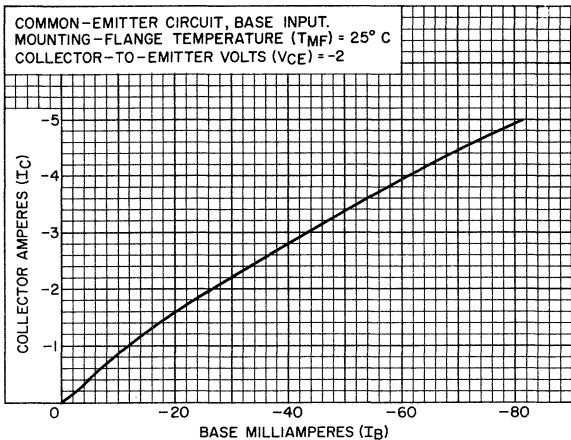
92CS-12467



92CS-12468

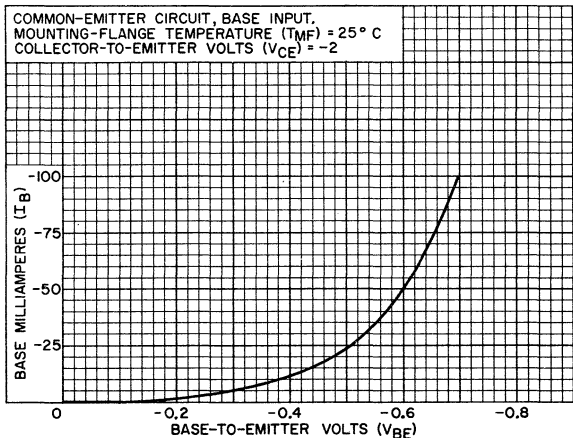


Typical Current-Transfer Characteristic



92CS-12469

Typical Input Characteristic



92CS-12470





Power Transistor

GERMANIUM P-N-P ALLOY TYPE

For High-Fidelity- and other Commercial-Audio-Frequency Amplifier Applications. In Push-Pull Class B Service delivers up to 25 watts.

The 40051 is the same as the 40050 except for the following items:

AUDIO-FREQUENCY POWER AMPLIFIER SERVICE

Maximum Ratings, Absolute-Maximum Values:

Collector-to-Base Voltage.	V_{CBO}	-50 max.	volts
With emitter open			
Collector-to-Emitter Voltage	V_{CEO}	-50 max.	volts
With base open			

ELECTRICAL CHARACTERISTICS

Mounting-flange temperature^a = 25° C, unless otherwise specified
Min. Typ. Max.

DC Collector-to-Base				
Breakdown Voltage.	BV_{CBO}	-50	-	volts
$I_C = -5$ ma., $I_E = 0$				
DC Collector-to-Emitter				
Breakdown Voltage.	BV_{CER}	-50	-	volts
$I_C = -600$ ma., $R_{BE} = 68$ ohms				

TYPICAL OPERATION

In accompanying "single-ended push-pull" class B AF-amp-lifier circuit at mounting-flange temperature^a of 25° C. Unless otherwise specified, values are for 2 transistors.

DC Collector Supply Voltage (V_{CC}) ^c	-22	volts
Zero-Signal Base-Bias Voltage.	-0.17	volt
Zero-Signal DC Collector Current	-0.05	amp
Maximum-Signal DC Collector Current.	-1.1	amp
Peak Collector Current	-3.5	amp
Input Impedance of Stage (Per base).	31	ohms
Load Impedance (Speaker voice-coil).	4	ohms
Maximum Collector Dissipation (Per transistor under worst-case conditions)	12.5	watts
Power Gain	28	db
Total Harmonic Distortion.	5	%
Music Power Output ^d	45	watts
Maximum-Signal Power Output.	25	watts

^a Measured at center of seating plane.

^c The data shown are for a dc collector supply having 10 per cent regulation.

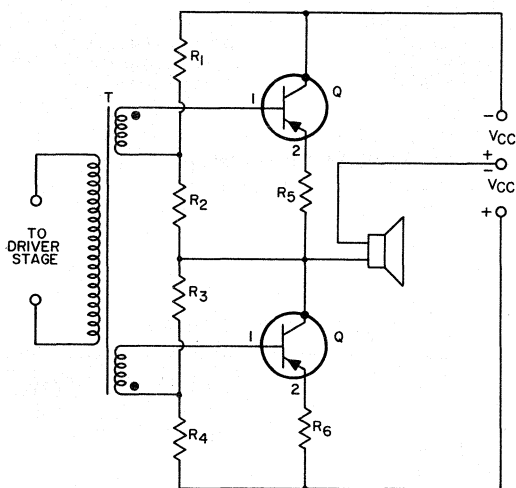
^d Determined according to EIA Standard RS234, Section 2.1.2.1.



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Electronic Components and Devices Harrison, N. J.

DATA
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"SINGLE-ENDED PUSH-PULL" CLASS B
AF AMPLIFIER-STAGE CIRCUIT



92CS-11332R2

- Q: Transistor type 40051
 R_1, R_3 : 470 ohms $\pm 10\%$, 1 watt
 R_2, R_4 : 3.9 ohms $\pm 10\%$, 0.5 watt
 R_5, R_6 : 0.33 ohm $\pm 10\%$, 0.5 watt
 Speaker: Voice-Coil Impedance. . 4 ohms

T: Driver Transformer. Primary-winding impedance, current-carrying capacity, and dc resistance determined by large-signal characteristics of driver stage; secondary windings bifilar wound, impedance of each winding = 100 ohms.

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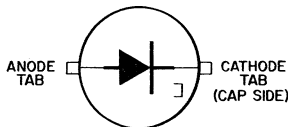
Tunnel Diodes

GALLIUM ARSENIDE TYPES

For Ultra-High-Speed Switching and Microwave Applications such as Computer Memory & Logic Circuits, Pulse Generators, and Microwave Frequency Converters & Oscillators

Mechanical:

Dimensions. See accompanying *Dimensional Outline*
Terminal Diagram (See accompanying *Dimensional Outline*):



The arrow indicates direction of forward current flow as indicated by dc ammeter.

Maximum Ratings, Absolute-Maximum Values:

Type Nos.	{	40058	40060	40062	40064	
		40059	40061	40063	40065	
DC Current:						
Forward ^a	I_F	0.5	0.5	0.5	0.5	ma/pf
Reverse at 25° C. . .	I_R	-250	-100	-50	-25	ma
Free-Air Temperature:						
Operating range . . .	T_{opr}	-30 to 85	-30 to 85	-30 to 85	-30 to 85	°C
Storage range . . .	T_{stg}	-30 to 85	-30 to 85	-30 to 85	-30 to 85	°C
Tab Soldering Temperature (3 sec. max.) . . .	T_T	175	175	175	175	°C
(See <i>Soldering Considerations</i>)						

Electrical Characteristics (Free-air temperature = 25° C)

Type Nos.	{	40058	40059	40060	40061	
Static ^b						
Peak-Point Current. .	I_P	50 ± 5%	50 ± 10%	20 ± 5%	20 ± 10%	ma
Peak-Point-to-Valley-Point Current Ratio (Min.). . . .	I_P/I_V	12/1	10/1	11/1	9/1	
Peak-Point Voltage (Max.).	V_P	200	200	180	180	mv
Valley-Point Voltage Minimum	V_V	500	450	500	450	mv
Typical	V_V	570	530	570	530	mv
Forward Voltage (Min.)	V_F	1050	1050	1000	900	mv



40058 to 40065

Type Nos. { 40058 40059 40060 40061

Dynamic^b

Minimum Negative Resistance ^c (Typ.) . . . -r _j (min)	4.4	4.4	11	11	ohms
Total Series Resistance (Max.) . . . r _s	3	3	8	8	ohms
Capacitance ^{d, e, f} (Max.) . . . C	20	40	15	30	pf
Total Series Inductance (Max.) . . . L _s	0.4	0.4	0.4	0.4	nh
Resistive Cutoff Frequency					
Minimum f _r	2	1	1	0.5	Gc
Typical f _r	5	2	3	1	Gc
Speed Index I _p /C _{tv}	3.6	1.8	2	1	ma/pf
Rise Time ^g (Typ.) . . . t _r	1/3	2/3	3/5	1-1/4	nsec

Type Nos. { 40062 40063 40064 40065

Static^b

Peak-Point Current. I _p	10 ± 5%	10 ± 10%	5 ± 5%	5 ± 10%	ma
Peak-Point-to-Valley-Point Current Ratio (Min.) I _p /I _v	10/1	9/1	10/1	8/1	
Peak-Point Voltage (Max.) . . . V _p	180	180	170	170	mv
Valley-Point Voltage					
Minimum V _v	500	450	500	420	mv
Typical V _v	570	530	550	520	mv
Forward Voltage (Min.) V _F	1000	900	950	900	mv

Dynamic^b

Minimum Negative Resistance ^c (Typ.) -r _j (min)	22	22	44	44	ohms
Total Series Resistance (Max.) r _s	9	9	12	12	ohms
Capacitance ^{d, e, f} (Max.) C	10	25	8	20	pf
Total Series Inductance (Max.) L _s	0.4	0.4	0.4	0.4	nh
Resistive Cutoff Frequency					
Minimum f _r	0.7	0.25	0.45	0.18	Gc
Typical f _r	2	0.7	1.2	0.45	Gc
Speed Index I _p /C _{tv}	1.2	0.6	1	0.4	ma/pf
Rise Time ^g (Typ.) . . . t _r	1	2	1-1/4	3	nsec



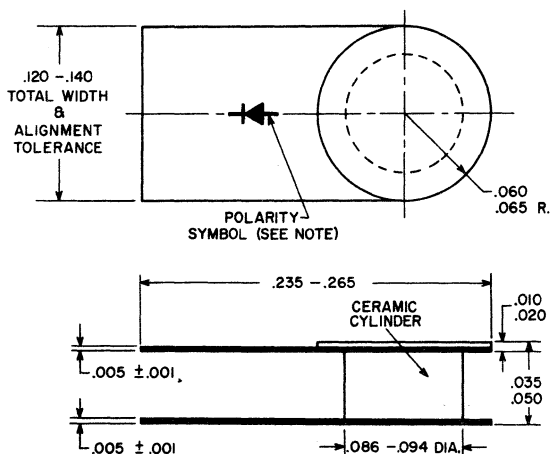
- a Above 25° C ambient derate linearly to I_V at 85° C. The maximum current in the forward voltage region for gallium arsenide tunnel diodes depends upon the junction capacitance. The forward current in milliamperes is determined by the following relationship:

$$\frac{I_{f \text{ max}}}{C_j} = 0.5 \frac{\text{ma}}{\text{pF}} \text{ at } 25^\circ \text{ C}$$

- b See Static Forward Characteristic Curve and Equivalent Circuit in *General Section under Symbols, Terms, and Definitions for Tunnel Diodes and Tunnel Rectifiers*.
- c value of $-r_j$ at inflection point of negative-resistance characteristic, calculated from the approximate relationship, $-r_j = \frac{220}{I_P}$, where I_P is in ma.
- d Terminal valley-point capacitance at measured I_V for individual diode, and includes case capacitance (C_p) of 0.8 pf.
- e Actual recorded capacitance readings are provided with each diode.
- f $C_j = C - 0.8 \text{ pf}$
- g For 20 per cent overdrive (dc forward voltage and driving pulse provided by constant-current sources).

SOLDERING INSTRUCTIONS

A low-temperature solder, (such as Alpha #111 Alloy, rosin-filled, or equivalent) should be used. A pre-tinned circuit board should be used to minimize soldering time. To protect the junction against overheating, the tunnel diode or tunnel rectifier should be held with long-nose pliers.



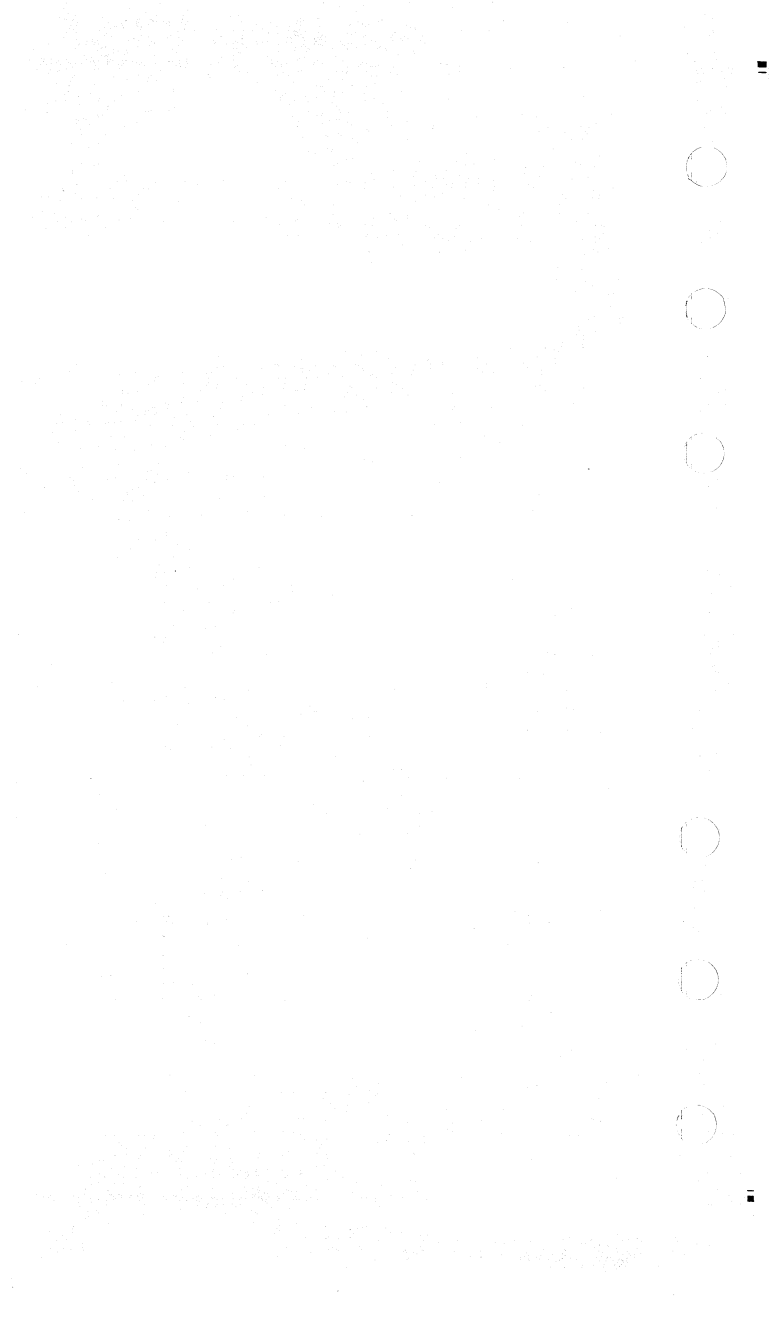
DIMENSIONS IN INCHES

Note: Arrow indicates direction of forward current flow as indicated by dc ammeter. Current will flow in this direction when the upper tab (cap side) is negative relative to the lower tab. (Arrow is not printed on the device).



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DATA 2
6-64



40080, 40081, 40082

Transistors

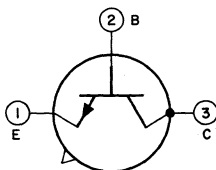
SILICON N-P-N TRIPLE-DIFFUSED PLANAR TYPES

RCA Types 40080, 40081, and 40082 are Specifically Designed For Use in Oscillator, Driver, and Power-Amplifier Applications, Respectively, in a 5-Watt Input, 27-Megacycle Citizens-Band Transmitter

Mechanical:

Dimensions. See Outline TO-39 in General Section
Terminal Diagram **BOTTOM VIEW**

Lead 1 - Emitter
Lead 2 - Base



Lead 3 - Collector,
Case

40080

For Oscillator Applications

Maximum Ratings, Absolute-Maximum Values:

Collector-to-Emitter Voltage. V_{CEO} 30 max. volts
With base open

Peak Collector Current. I_C 0.25 max. amp

Transistor Dissipation

At free-air temperatures:

From -65° to 25° C. P_T 0.5 max. watt

Above 25° C. Derate linearly
0.003 watt/ $^{\circ}$ C

Temperature

Operating range (Junction). T_{opr} -65 to 175 $^{\circ}$ C

Storage range T_{stg} -65 to 175 $^{\circ}$ C

Typical Performance in a Citizens-Band Transmitter:

DC Collector Supply Voltage 13.8 volts

DC Collector Current

No modulation 15 ma

100% modulation 15 ma

ELECTRICAL CHARACTERISTICS

Free-air temperature = 25° C

Min. Max.

DC Collector-to-Emitter

Breakdown Voltage BV_{CEO} 30 - volts

$I_C = 10$ ma., $I_B = 0$



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DATA 1
6-64

40080, 40081, 40082

40080 (Cont'd)

		Min.	Max.	
DC Collector-Cutoff Current.	I_{CBO}	-	10	μa
$V_{CB} = 15$ volts, $I_E = 0$				
RF Power Output.	P_o	100	-	mw
$f = 27$ Mc, $V_{CC} = 12$ volts, $I_C = 32$ max. ma				

40081

For Driver Applications

Maximum Ratings, Absolute-Maximum Values:

Collector-to-Emitter Voltage	V_{CEX}	60 max.	volts
With reverse bias $V_{EB} = 0.5$ volt			
Emitter-to-Base Voltage.	V_{EBO}	2 max.	volts
With collector open			
Peak Collector Current	I_C	0.25 max.	amp
Transistor Dissipation			
At case temperatures:			
From -65° to 25° C	P_T	2 max.	watts
Above 25° C.		Derate linearly 0.013 watt/ $^{\circ}$ C	

Temperature

Operating range (Junction)	T_{opr}	-65 to 175	$^{\circ}$ C
Storage range.	T_{stg}	-65 to 175	$^{\circ}$ C

Typical Performance in a Citizens-Band Transmitter:

DC Collector Supply Voltage.	13.8	volts
DC Collector Current		
No modulation.	55	ma
100% modulation.	50	ma

ELECTRICAL CHARACTERISTICS

Free-air temperature = 25° C

		Min.	Max.	
DC Collector-to-Emitter				
Breakdown Voltage.	BV_{CEX}	60	-	volts
With reverse bias $V_{EB} = 0.5$ volt, $I_C = 100 \mu a$				
DC Emitter-to-Base Breakdown				
Voltage.	BV_{EBO}	2	-	volts
$I_E = 500 \mu a$, $I_C = 0$				
DC Collector-Cutoff Current.	I_{CBO}	-	10	μa
$V_{CB} = 15$ volts, $I_E = 0$				
RF Power Output.	P_o	400	-	mw
$f = 27$ Mc, $V_{CC} = 12$ volts, $I_C = 85$ max. ma , rf $P_i = 75$ mw				



40082

For Power-Amplifier Applications

Maximum Ratings, Absolute-Maximum Values:

Collector-to-Emitter Voltage. V_{CEX} 60 max. volts
 With reverse bias $V_{EB} = 0.5$ volt

Emitter-to-Base Voltage V_{EBO} 2.5 max. volts
 With collector open

Peak Collector Current. I_C 1.5 max. amp

Transistor Dissipation

At case temperatures:

From -65° to 25° C. P_T 5 max. watts

Above 25° C. *Derate linearly*
 0.033 watts/ $^{\circ}$ C

Temperature

Operating range (Junction). T_{opr} -65 to 175 $^{\circ}$ C

Storage range T_{stg} -65 to 175 $^{\circ}$ C

Typical Performance in a Citizens-Band Transmitter:

DC Collector Supply Voltage 13.8 volts

DC Collector Current

No modulation 330 ma

100% modulation 330 ma

Power Output

No modulation 3.5^a watts

100% modulation 4.8 watts

ELECTRICAL CHARACTERISTICS

Free-air temperature = 25° C

Min. Max.

DC Collector-to-Emitter

Breakdown Voltage. BV_{CEX} 60 - volts

With reverse bias $V_{EB} = 0.5$ volt,

$I_C = 500$ μ a

DC Emitter-to-Base Breakdown

Voltage. BV_{EBO} 2.5 - volts

$I_E = 500$ μ a, $I_C = 0$

DC Collector-Cutoff Current.

$V_{CB} = 15$ volts, $I_E = 0$ I_{CBO} - 10 μ a

RF Power Output.

$f = 27$ Mc, $V_{CC} = 12$ volts, P_o 3 - watts

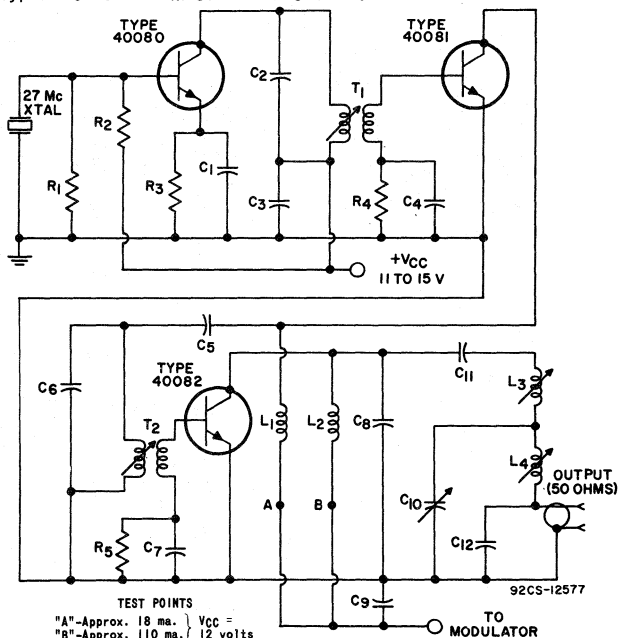
$I_C = 415$ max. ma, rf $P_i = 350$ mw

^a Adjusted for legal maximum-power output.



40080, 40081, 40082

Typical Circuit of RF Section of 5-Watt Citizens-Band Transmitter



- C_1 : 75 pf, ceramic
 C_2 : 30 pf, ceramic
 C_3, C_4, C_7 : 0.01 μ f, ceramic
 C_5 : 47 pf, ceramic
 C_6 : 51 pf, mica
 C_8 : 24 pf, mica
 C_9 : 0.01 μ f, ceramic
 C_{10} : variable capacitor, 90 to 400 pf (Arco No.429, or equivalent)
 C_{11} : 100 pf, ceramic
 C_{12} : 220 pf, ceramic
 L_1, L_2 : radio-frequency choke, 15 μ f (Miller No.4624, or equivalent)
 L_3 : variable inductor, 11 turns No.22 wire, wound on CTC 1/4" diameter coil form having a "green-dot" core, 0.5 to 0.9 μ h, $Q = 120$

- L_4 : variable inductor, 7 turns No.22 wire, wound on CTC 1/4" diameter coil form having a "green-dot" core, 0.21 to 0.34 μ h, $Q = 140$
 R_1 : 510 ohms, 0.5 watt
 R_2 : 5100 ohms, 0.5 watt
 R_3 : 51 ohms, 0.5 watt
 R_4 : 120 ohms, 0.5 watt
 R_5 : 47 ohms, 0.5 watt
 T_1 : rf transformer, primary 14 turns, secondary 3 turns No.22 wire, wound on CTC 1/4" diameter coil form having a "green-dot" core, slug-tuned, 0.75 to 1.2 μ h, $Q = 100$
 T_2 : rf transformer, primary 14 turns, secondary 2-3/4 turns No.22 wire, wound on CTC 1/4" diameter coil form having a "green-dot" core, slug-tuned, 0.75 to 1.2 μ h, $Q = 100$

Transistor

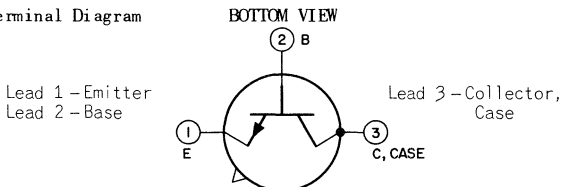
SILICON N-P-N TRIPLE-DIFFUSED PLANAR TYPE

For a Wide Variety of Small-Signal, Medium Power Applications (Up to 20 Mc) in Commercial and Industrial Equipment

Mechanical:

Dimensions. See Outline TO-18 in General Section

Terminal Diagram



Maximum Ratings, Absolute-Maximum Values:

Collector-to-Base Voltage. . . V_{CBO} 60 max. volts
With emitter open

Collector-to-Emitter Voltage

With base-to-emitter reverse

bias dc volts = -1.5 . . . V_{CEV} 60 max. volts

With external base-to-emitter resistance

(ohms) = 10. V_{CER} 50 max. volts

With base open

(Sustaining voltage) . . $V_{CEO(sus)}$ 40 max. volts

Emitter-to-Base Voltage. . . V_{EBO} 5 max. volts

With collector open

Collector Current. I_C 0.7 max. amp

Transistor Dissipation

At case temperatures:^a

From -65° to 25° C P_T 1.8 max. watts

Above 25° C. Derate linearly 0.010 watt/°C

Temperature

Operating range. T_{opr} -65 to 200 °C

Storage range. T_{stg} -65 to 200 °C

Leads:^b

For 10 seconds maximum . . T_L 255 max. °C

ELECTRICAL CHARACTERISTICS

Case temperature^a = 25° C

Min. Max.

DC Collector-to-Base Breakdown

Voltage. BV_{CBO} 60 - volts

$I_C = 0.1$ ma., $I_E = 0$



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DATA 1
3-64

Min. Max.

DC Collector-to-Emitter

Sustaining Voltage

 I_C (Pulsed) = 100 ma.^c, $R_{BE} = 10$ ohms. $V_{CEr(sus)}$ 50 - volts I_C (Pulsed) = 100 ma.^c, $I_B = 0$ $V_{CEO(sus)}$ 40 - volts

DC Base-to-Emitter

Saturation Voltage $V_{BE(sat)}$ - 1.7 volts $I_C = 150$ ma., $I_B = 15$ ma.

DC Collector-to-Emitter

Saturation Voltage $V_{CE(sat)}$ - 1.4 volts $I_C = 150$ ma., $I_B = 15$ ma.

DC Collector-Cutoff

Current. I_{CBO} - 0.25 μ a $V_{CB} = 30$ volts, $I_E = 0$ DC Emitter-Cutoff Current. I_{EBO} - 0.25 μ a $V_{EB} = 4$ volts, $I_C = 0$ Input Capacitance. C_{ib} - 80 pf $V_{EB} = 0.5$ volt, $I_C = 0$ Output Capacitance C_{ob} - 15 pf $V_{CB} = 10$ volts, $I_E = 0$

DC Forward-Current

Transfer Ratio h_{FE} 50 250 $V_{CE} = 10$ volts, I_C (Pulsed) = 150 ma.^c

Small-Signal Short-Circuit

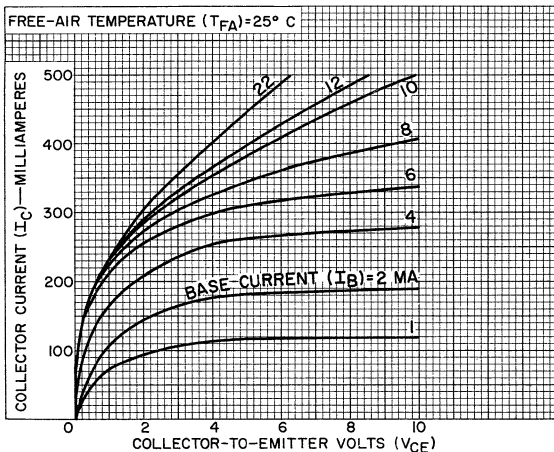
Forward-Current Transfer

Ratio. h_{fe} 5 - $f = 20$ Mc, $V_{CE} = 10$ volts, $I_C = 50$ ma.

Thermal Resistance

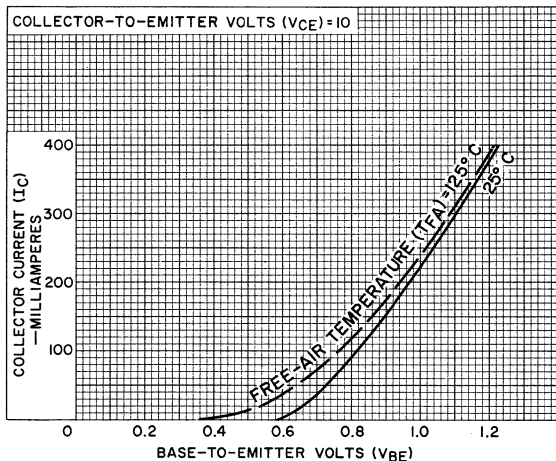
Junction-to-case θ_{JC} - 97 $^{\circ}\text{C}/\text{watt}$ Junction-to-free-air θ_{JFA} - 350 $^{\circ}\text{C}/\text{watt}$ ^a Measured at center of seating plane.^b Measured $1/16" \pm 1/32"$ along lead from seating plane.^c Pulse duration = 300 μ seconds, duty factor = 0.018.

Typical Collector Characteristics



92CS-12327

Typical Transfer Characteristics



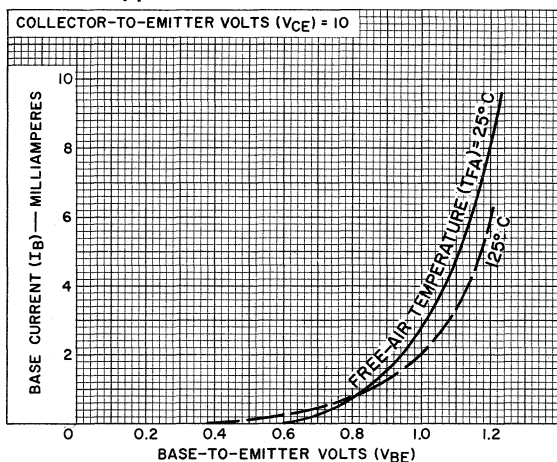
92CS-12328



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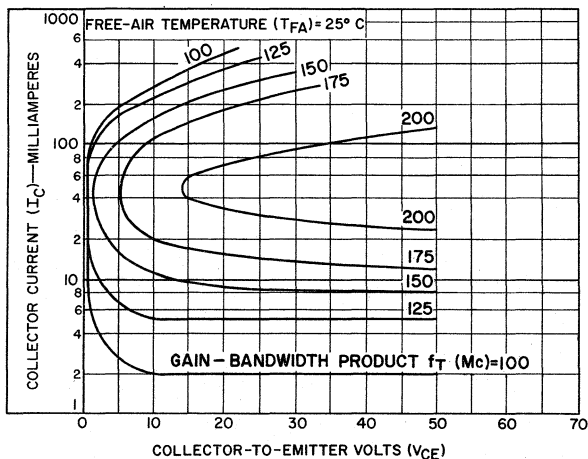
DATA 2
3-64

Typical Base Characteristics



92CS-12329

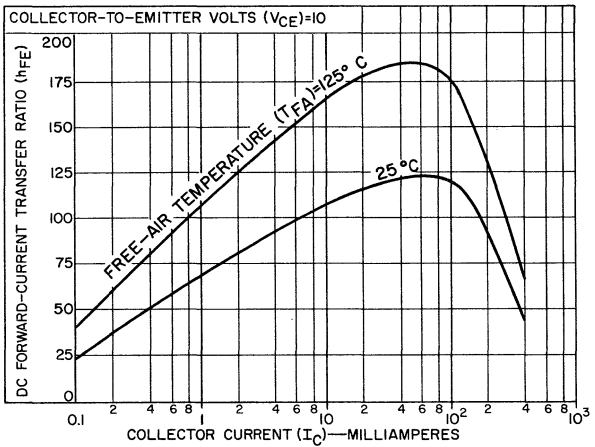
Typical Gain-Bandwidth-Product Characteristics



92CS-12335

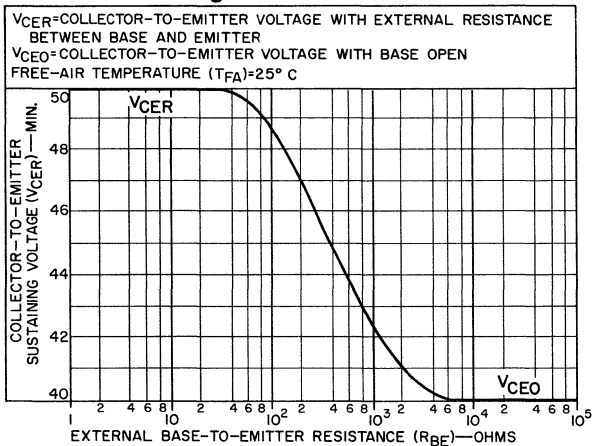


Typical DC Forward-Current Transfer-Ratio Characteristics



92CS-12331

Typical Collector-to-Emitter Voltage Characteristics



92CS-12332RI



Silicon Rectifiers

DIFFUSED-JUNCTION TYPES

For Power Supplies in Industrial Applications

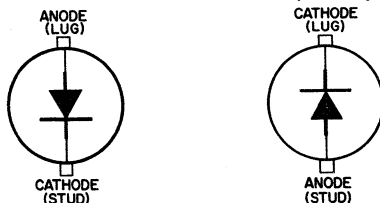
Type 40108R is a reverse-polarity version of type 40108

Mechanical:

Dimensions. See Outline DO-4 in General Section

Terminal Diagrams:

Reverse-polarity version



The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps, single-phase operation, and with resistive or inductive load

Peak Reverse Voltage	50 max.	volts
DC Blocking Voltage.	50 max.	volts
Average Forward Current		
At case temperature of 150° C.	10 max.	amp
Peak Recurrent Current	40 max.	amp
Peak Surge Current ^a		
At case temperature of 150°C:		
For one-half cycle, sine wave.	140 max.	amp
Case-Temperature Range		
Operating and storage.	-65 to 175	°C

Characteristics:

Maximum Forward Voltage Drop (Averaged over one complete cycle for maximum peak reverse volts, maximum average forward current = 10 amperes, case temperature = 150° C) . .	0.6	volt
Maximum Reverse Current		
Dynamic (Averaged over one complete cycle for maximum peak reverse volts, maximum average forward current = 10 amperes, case temperature = 150° C)	2	ma
Static (DC value for maximum peak reverse volts, case temperature = 25° C) . . .	0.075	ma



40108, 40108R

^a Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal-equilibrium conditions.

OPERATING CONSIDERATIONS

Because these rectifiers may operate at voltages which are dangerous, care should be taken in the design of equipment to prevent the operator from coming incontact with the rectifier.

The recommended installation torque is 15 to 20 inch-pounds applied to a 10-32 UNF-2B hex nut assembled on stud thread.

The applied torque during installation should not exceed 25 inch-pounds.

MOUNTING HARDWARE

Mounting nut and lock washer are furnished with each rectifier.



40109, 40109R

Silicon Rectifiers

DIFFUSED-JUNCTION TYPES For Power Supplies in Industrial Applications

*Type 40109R is a reverse-polarity version of type 40109
The 40109, 40109R are the same as the 40108, 40108R respectively,
except for the following items:*

HALF-WAVE RECTIFIER

Maximum Ratings, Absolute-Maximum Values:

*For power-supply frequency of 60 cps, single-phase
operation, and with resistive or inductive load*

Peak Reverse Voltage.	100 max.	volts
DC Blocking Voltage	100 max.	volts

40110, 40110R

Silicon Rectifiers

DIFFUSED-JUNCTION TYPES For Power Supplies in Industrial Applications

*Type 40110R is a reverse-polarity version of type 40110
The 40110, 40110R are the same as the 40108, 40108R respectively,
except for the following items:*

HALF-WAVE RECTIFIER

Maximum Ratings, Absolute-Maximum Values:

*For power-supply frequency of 60 cps, single-phase
operation, and with resistive or inductive load*

Peak Reverse Voltage.	200 max.	volts
DC Blocking Voltage	200 max.	volts

Characteristics:

Maximum Reverse Current

*Dynamic (Averaged over one complete cycle
for maximum peak reverse volts, maximum
average forward current = 10 amperes,
case temperature = 150° C).*

1.5	ma
-----	----



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DATA
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40111, 40111R

Silicon Rectifiers

DIFFUSED-JUNCTION TYPES

For Power Supplies in Industrial Applications

Type 40111R is a reverse-polarity version of type 40111

The 40111, 40111R are the same as the 40108, 40108R respectively, except for the following items:

HALF-WAVE RECTIFIER

Maximum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps, single-phase operation, and with resistive or inductive load

Peak Reverse Voltage. 300 max. volts

DC Blocking Voltage 300 max. volts

Characteristics:

Maximum Reverse Current

Dynamic (Averaged over one complete cycle
for maximum peak reverse volts, maximum
average forward current = 10 amperes,
case temperature = 150° C).

1.5 ma

40112, 40112R

Silicon Rectifiers

DIFFUSED-JUNCTION TYPES

For Power Supplies in Industrial Applications

Type 40112R is a reverse-polarity version of type 40112

The 40112, 40112R are the same of the 40108, 40108R respectively, except for the following items:

HALF-WAVE RECTIFIER

Maximum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps, single-phase operation, and with resistive or inductive load

Peak Reverse Voltage. 400 max. volts

DC Blocking Voltage 400 max. volts

Characteristics:

Maximum Reverse Current

Dynamic (Averaged over one complete cycle
for maximum peak reverse volts, maximum
average forward current = 10 amperes,
case temperature = 150° C).

1 ma



40113, 40113R

Silicon Rectifiers

DIFFUSED-JUNCTION TYPES

For Power Supplies in Industrial Applications

Type 40113R is a reverse-polarity version of type 40113

The 40113, 40113R are the same as the 40108, 40108R respectively, except for the following items:

HALF-WAVE RECTIFIER

Maximum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps, single-phase operation, and with resistive or inductive load

Peak Reverse Voltage. 500 max. volts

DC Blocking Voltage 500 max. volts

Characteristics:

Maximum Reverse Current

Dynamic (Averaged over one complete cycle
for maximum peak reverse volts, maximum
average forward current = 10 amperes,
case temperature = 150° C).

0.85 ma

40114, 40114R

Silicon Rectifiers

DIFFUSED-JUNCTION TYPES

For Power Supplies in Industrial Applications

Type 40114R is a reverse-polarity version of type 40114

The 40114, 40114R are the same as the 40108, 40108R respectively, except for the following items:

HALF-WAVE RECTIFIER

Maximum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps, single-phase operation, and with resistive or inductive load

Peak Reverse Voltage. 600 max. volts

DC Blocking Voltage 600 max. volts

Characteristics:

Maximum Reverse Current

Dynamic (Averaged over one complete cycle
for maximum peak reverse volts, maximum
average forward current = 10 amperes,
case temperature = 150° C).

0.75 ma



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Electronic Components and Devices Harrison, N. J.

DATA
3-64

40115, 40115R

Silicon Rectifiers

DIFFUSED-JUNCTION TYPES

For Power Supplies in Industrial Applications

Type 40115R is a reverse-polarity version of type 40115

The 40115, 40115R are the same as the 40108, 40108R respectively, except for the following items:

HALF-WAVE RECTIFIER

Maximum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps, single-phase operation, and with resistive or inductive load

Peak Reverse Voltage. 800 max. volts

DC Blocking Voltage 800 max. volts

Characteristics:

Maximum Reverse Current

Dynamic (Averaged over one complete cycle

for maximum peak reverse volts, maximum

average forward current = 10 amperes,

case temperature = 150° C). 0.65 ma

40116, 40116R

Silicon Rectifiers

DIFFUSED-JUNCTION TYPES

For Power Supplies in Industrial Applications

Type 40116R is a reverse-polarity version of type 40116

The 40116, 40116R are the same as the 40108, 40108R respectively, except for the following items:

HALF-WAVE RECTIFIER

Maximum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps, single-phase operation, and with resistive or inductive load

Peak Reverse Voltage. 1000 max. volts

DC Blocking Voltage 1000 max. volts

Characteristics:

Maximum Reverse Current

Dynamic (Averaged over one complete cycle

for maximum peak reverse volts, maximum

average forward current = 10 amperes,

case temperature = 150° C). 0.5 ma



40208, 40208R

Silicon Rectifiers

DIFFUSED-JUNCTION TYPES

For Power Supplies in Industrial Applications

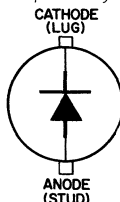
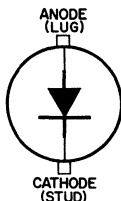
Type 40208R is a reverse-polarity version of type 40208

Mechanical:

Dimensions. See Outline DO-5 in General Section

Terminal Diagrams:

Reverse-polarity version



The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps, single-phase operation, and with resistive or inductive load

Peak Reverse Voltage.	50 max.	vols
DC Blocking Voltage.	50 max.	vols
Average Forward Current.	18 max.	amp
At case temperature of 150° C		
Peak Recurrent Current.	72 max.	amp
Peak Surge Current ^a	250 max.	amp
At case temperature of 150° C		
For one-half cycle, sine wave		
Case Temperature Range.	-65 to 175	°C
Operating and storage		

Characteristics:

Maximum Forward Voltage Drop.	0.65	volt
(Averaged over one complete cycle for maximum peak reverse volts, maximum average forward current = 18 amperes case temperature = 150° C)		

Maximum Reverse Current

Dynamic (Averaged over one complete cycle for maximum peak reverse volts, maximum average forward current = 18 amperes, case temperature = 150° C) . .		
	3	ma
Static (DC value for maximum peak reverse volts, case temperature = 25° C).		
	0.1	ma



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DATA
3-64

40208, 40208R

^a Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal-equilibrium conditions.

OPERATING CONSIDERATIONS

Because these rectifiers may operate at voltages which are dangerous, care should be taken in the design of equipment to prevent the operator from coming in contact with the rectifier.

The recommended installation torque is 26 to 36 inch-pounds applied to a 1/4-28 UNF-2B nut assembled on stud thread.

The applied torque during installation should not exceed 50 inch-pounds.

MOUNTING HARDWARE

Mounting nut and lock washer are furnished with each rectifier.



40209, 40209R

Silicon Rectifiers

DIFFUSED-JUNCTION TYPES

For Power Supplies in Industrial Applications

*Type 40209R is a reverse-polarity version of type 40209
The 40209, 40209R are the same as the 40208, 40208R respectively,
except for the following items:*

HALF-WAVE RECTIFIER

Maximum Ratings, Absolute-Maximum Values:

*For power-supply frequency of 60 cps, single-phase
operation, and with resistive or inductive load*

Peak Reverse Voltage. 100 max. volts
DC Blocking Voltage 100 max. volts

40210, 40210R

Silicon Rectifiers

DIFFUSED-JUNCTION TYPES

For Power Supplies in Industrial Applications

*Type 40210R is a reverse-polarity version of type 40210
The 40210, 40210R are the same as the 40208, 40208R respectively,
except for the following items:*

HALF-WAVE RECTIFIER

*For power-supply frequency of 60 cps, single-phase
operation, and with resistive or inductive load*

Peak Reverse Voltage. 200 max. volts
DC Blocking Voltage 200 max. volts

Characteristics:

Maximum Reverse Current 2.5 ma
Dynamic (Averaged over one complete cycle
for maximum peak reverse volts, maximum
average forward current = 18 amperes,
case temperature = 150° C)



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DATA
3-64

40211, 40211R

Silicon Rectifiers

DIFFUSED-JUNCTION TYPES

For Power Supplies in Industrial Applications

Type 40211R is a reverse-polarity version of type 40211

The 40211, 40211R are the same as the 40208, 40208R respectively, except for the following items:

HALF-WAVE RECTIFIER

Maximum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps, single-phase operation, and with resistive or inductive load

Peak Reverse Voltage. 300 max. volts
DC Blocking Voltage 300 max. volts

Characteristics:

Maximum Reverse Current 2.5 ma
Dynamic (Average over one complete cycle for maximum peak reverse volts, maximum average forward current = 18 amperes, case temperature = 150° C)

40212, 40212R

Silicon Rectifiers

DIFFUSED-JUNCTION TYPES

For Power Supplies in Industrial Applications

Type 40212R is a reverse-polarity version of type 40212

The 40212, 40212R are the same as the 40208, 40208R respectively, except for the following items:

HALF-WAVE RECTIFIER

Maximum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps, single-phase operation, and with resistive or inductive load

Peak Reverse Voltage. 400 max. volts
DC Blocking Voltage 400 max. volts

Characteristics:

Maximum Reverse Current 2 ma
Dynamic (Average over one complete cycle for maximum peak reverse volts, maximum average forward current = 18 amperes, case temperature = 150° C)



40213, 40213R

Silicon Rectifiers

DIFFUSED-JUNCTION TYPES

For Power Supplies in Industrial Applications

Type 40213R is a reverse-polarity version of type 40213

The 40213, 40213R are the same as the 40208, 40208R respectively, except for the following items:

HALF-WAVE RECTIFIER

Maximum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps, single-phase operation, and with resistive or inductive load

Peak Reverse Voltage	500 max.	volts
DC Blocking Voltage.	500 max.	volts

Characteristics:

Maximum Reverse Current.	1.75	ma
Dynamic (Average over one complete cycle for maximum peak reverse volts, maximum average forward current = 18 amperes, case temperature = 150° C)		

40214, 40214R

Silicon Rectifiers

DIFFUSED-JUNCTION TYPES

For Power Supplies in Industrial Applications

Type 40214R is a reverse-polarity version of type 40214

The 40214, 40214R are the same as the 40208, 40208R respectively, except for the following items:

HALF-WAVE RECTIFIER

Maximum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps, single-phase operation, and with resistive or inductive load

Peak Reverse Voltage.	600 max.	volts
DC Blocking Voltage	600 max.	volts

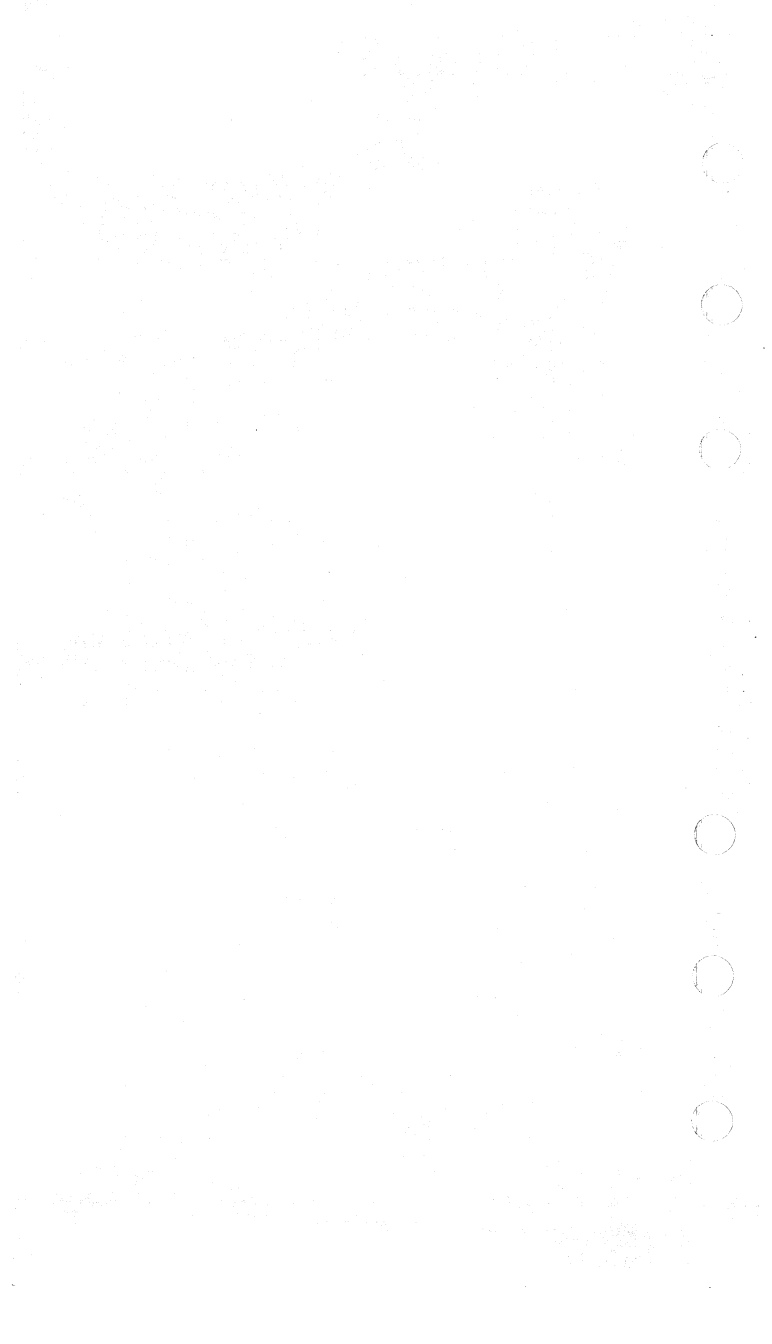
Characteristics:

Maximum Reverse Current	1.5	ma
Dynamic (Average over one complete cycle for maximum peak reverse volts; maximum average forward current = 18 amperes, case temperature = 150° C)		



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Harrison, N. J.

DATA
3-64



40217

Transistor

SILICON N-P-N PLANAR EPITAXIAL TYPE

*For Switching and Amplifier Applications
in Military and Industrial Equipment*

The 40217 is the same as the 2N706 except it utilizes a JEDEC TO-52 case.

Dimensions. See Outline TO-52 in General Section

40218

Transistor

SILICON N-P-N PLANAR EPITAXIAL TYPE

*For Switching and Amplifier Applications
in Military and Industrial Equipment*

The 40218 is the same as the 2N706A except it utilizes a JEDEC TO-52 case.

Dimensions. See Outline TO-52 in General Section

40219

Transistor

SILICON N-P-N PLANAR EPITAXIAL TYPE

*For Switching and Amplifier Applications
in Military and Industrial Equipment*

The 40219 is the same as the 2N708 except it utilizes a JEDEC TO-52 case.

Dimensions. See Outline TO-52 in General Section



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DATA
5-65

40220

Transistor

SILICON N-P-N PLANAR EPITAXIAL TYPE

*For Switching and Amplifier Applications
in Military and Industrial Equipment*

The 40220 is the same as the 2N834 except it utilizes a JEDEC TO-52 case.

Dimensions. See Outline TO-52 in General Section

40221

Transistor

SILICON N-P-N PLANAR EPITAXIAL TYPE

*For Switching and Amplifier Applications
in Military and Industrial Equipment*

The 40221 is the same as the 2N914 except it utilizes a JEDEC TO-52 case.

Dimensions. See Outline TO-52 in General Section

40222

Transistor

SILICON N-P-N PLANAR EPITAXIAL TYPE

*For Switching and Amplifier Applications
in Military and Industrial Equipment*

The 40222 is the same as the 2N2205 except it utilizes a JEDEC TO-52 case.

Dimensions. See Outline TO-52 in General Section



40231, 40232, 40233, 40234

Transistors

SILICON N-P-N PLANAR TYPES

COLLECTOR INTERNALLY
CONNECTED TO CASE

HERMETICALLY SEALED
PACKAGE

For Low-to-Intermediate Signal Level AF-Amplifier Applications. Type 40233 is Specially Controlled for Low Noise and Low Leakage for Use in Preamplifiers. Types 40231, 40232, and 40234 are Useful as "Voltage-Amplifiers" and Drivers.

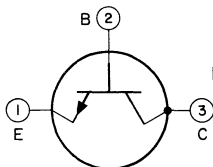
Mechanical:

Dimensions. See accompanying *Dimensional Outline*

Terminal Diagram

BOTTOM VIEW

Lead 1 - Emitter
Lead 2 - Base



Lead 3 - Collector,
Case

Maximum Ratings, *Absolute-Maximum Values*:

		40231 40232	40233 40234	
Collector-to-Base Voltage.	V_{CBO}	18 max.		volts
With emitter open				
Collector-to-Emitter Voltage . . .	V_{CEO}	18 max.		volts
With base open				
Emitter-to-Base Voltage.	V_{EBO}	5 max.		volts
With collector open				
Collector Current.	I_C	100 max.		ma
Emitter Current.	I_E	100 max.		ma
Base Current	I_B	25 max.		ma

Transistor Dissipation

At case temperatures^a

From -65° to 125° C. P_T 1 max. watt

Above 125° C Derate linearly 0.02 watt/ $^{\circ}$ C

At free-air temperatures

From -65° to 25° C P_T 0.5 max. watt

Above 25° C Derate linearly 0.0033 watt/ $^{\circ}$ C

Temperature

Operating range (Junction) . . . T_{opr} -65 to 175 $^{\circ}$ C

Storage range. T_{stg} -65 to 175 $^{\circ}$ C

Lead-Soldering Temperature^b. . . T_L 255 max. $^{\circ}$ C
(For 10 sec. max.)



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DATA 1
8-64

40231, 40232, 40233, 40234

ELECTRICAL CHARACTERISTICS

Unless otherwise specified, electrode-voltage and electrode-current values for given test conditions are dc; free-air temperature = 25° C

	40231	40232	40233	40234		
Collector-to-Base Breakdown Voltage. . . BV _{CBO}	18	18	18	18	min.	volts
I _C = 50 μ a, I _E = 0						
Collector-to-Emitter Breakdown Voltage. . . BV _{CEO}	18	18	18	18	min.	volts
I _C = 10 ma, I _B = 0						
Emitter-to-Base Breakdown Voltage BV _{EBO}	5	5	5	5	min.	volts
I _E = 50 μ a, I _C = 0						
Collector-Cutoff Current						
V _{CB} = 12 volts, I _E = 0						
T _{FA} = 25° C. I _{CBO}	0.5	0.5	0.25	0.5	max.	μ a
T _{FA} = 85° C. I _{CBO}	10	10	10	10	max.	μ a
Emitter Cutoff Current I _{EBO}	0.5	0.5	0.25	0.5	max.	μ a
V _{EB} = 2.5 volts, I _C = 0						
Small-Signal Short-Circuit Forward Current Transfer Ratio.						
f = 1 kc, h _{fe}	55	90	90	35	min.	
I _C = 2 ma, h _{fe}	80	175	175	80	typ.	
V _{CE} = 10 volts, h _{fe}	180	300	300	470	max.	
Gain-Bandwidth Product f _T	60	60	60	60	typ.	Mc
V _{CE} = 6 volts, I _C = 1 ma						
Base-Spreading Resistance. . . r _{bb'}	20	20	20	20	typ.	ohms
f = 100 Mc, V _{CE} = 6 volts, I _C = 1 ma						
Output Capacitance C _{ob}	22	22	22	22	typ.	pf
f = 1 Mc, V _{CB} = 6 volts, I _E = 0						



40231, 40232, 40233, 40234

	40231	40232	40233	40234		
Noise Figure						
Circuit Bandwidth = 1 cps, $R_G = 1000$ ohms, $V_{CE} = 6$ volts,						
$I_C = 0.1$ ma,						
$f = 10$ kc.	NF	2.8	2.8	2	2.8	typ. db
$I_C = 0.5$ ma,						
$f = 1$ kc.	NF	-	-	4	-	typ. db
	NF	-	-	6	-	max. db
Thermal Resistance						
Junction-to-case ^c . θ_{JC}	50	50	50	50	max.	$^{\circ}\text{C}/\text{w}$
Junction-to-free air ^c θ_{JFA}	300	300	300	300	max.	$^{\circ}\text{C}/\text{w}$

^a Measured on case perimeter at junction with seating surface.

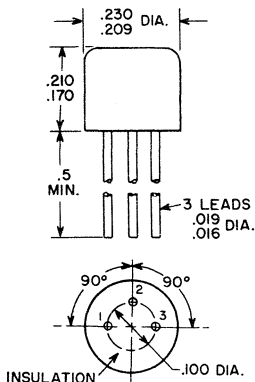
^b Measured along lead at distance not less than 1/32" from seating plane.

^c Junction Temperature = 175 $^{\circ}$ C.

OPERATING CONSIDERATIONS

These transistors should not be connected into or disconnected from circuits with the power on because high transient currents may damage them permanently.

The cases of these transistors are connected internally to the collector electrodes. Consequently, in circuits where the collectors are operated at voltages above or below chassis or heat-sink potential, suitable precautions should be taken to prevent shock hazards and short circuits between the transistors and chassis, heat sinks, and other components.



92CS-12478

DIMENSIONS IN INCHES

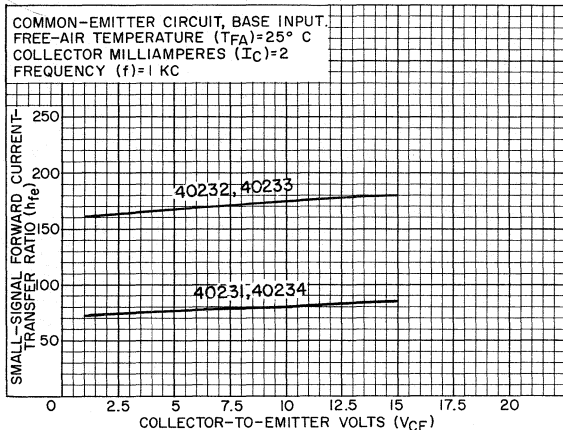


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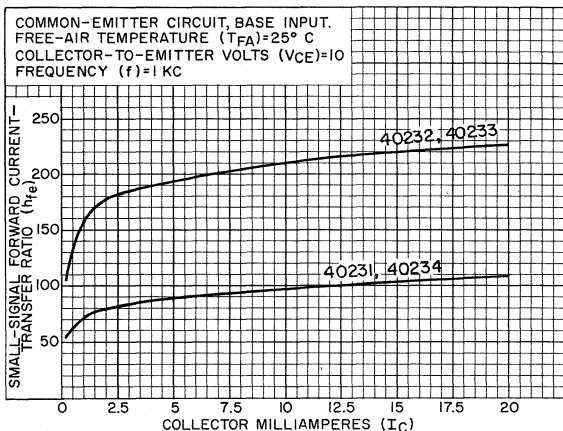
DATA 2
8-64

40231, 40232, 40233, 40234

Typical Small-Signal Forward-Current Transfer- Ratio Characteristics for Types 40231 through 40234



92CS-12597

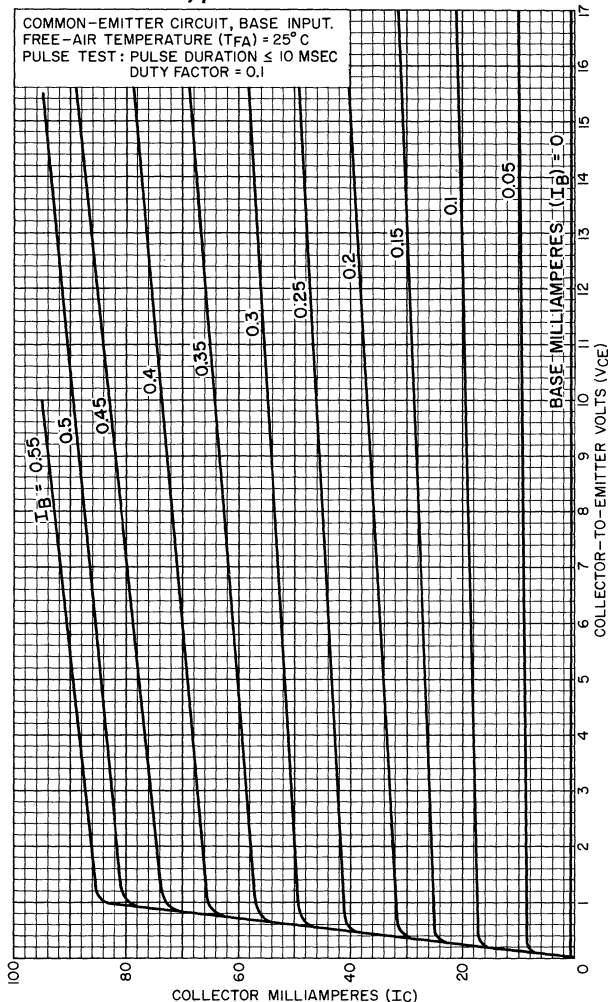


92CS-12600



40231, 40232, 40233, 40234

Typical Collector Characteristics (Pulse Conditions) for Types 40232 and 40233



92CM-12593

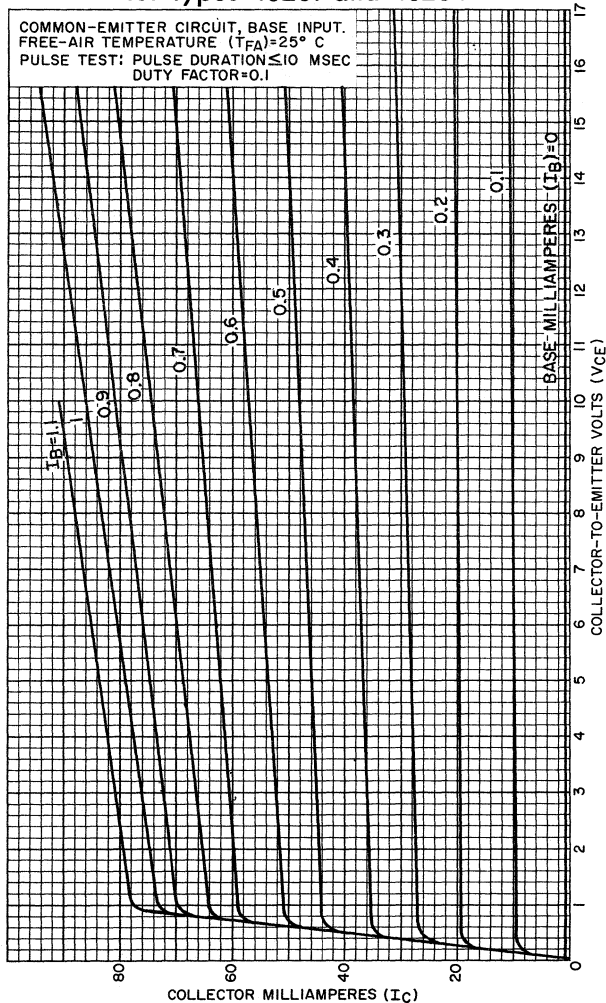


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DATA 3
8-64

40231, 40232, 40233, 40234

Typical Collector Characteristics (Pulse Conditions) for Types 40231 and 40234

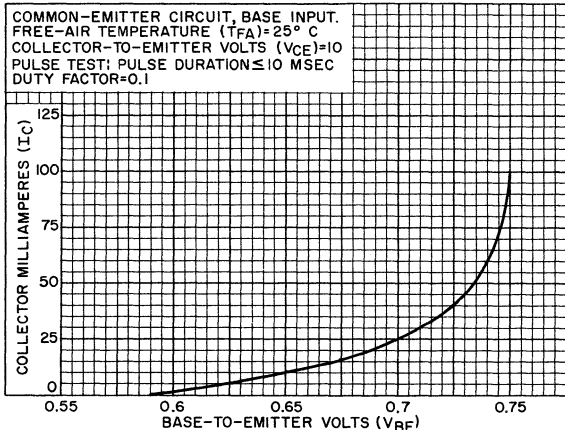


92CM-12595



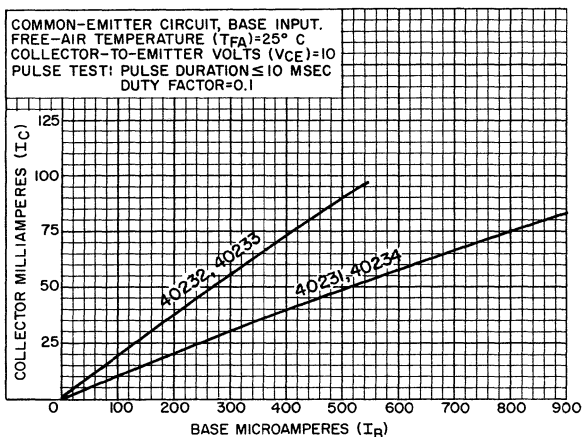
40231, 40232, 40233, 40234

Typical Transfer Characteristic (Pulse Conditions) for Types 40231 through 40234



92CS-12598

Typical DC Forward-Current Transfer-Ratio for Types 40231 through 40234



92CS-12596

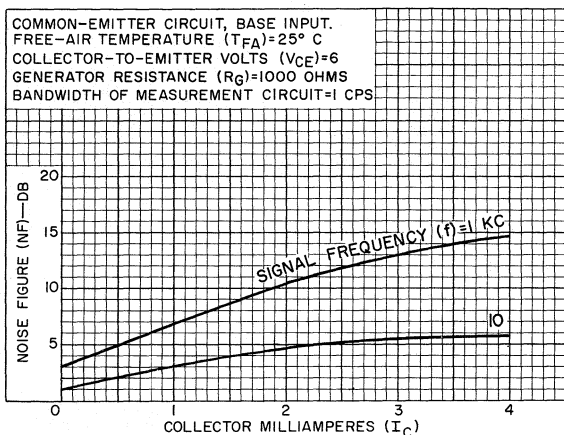


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DATA 4
8-64

40231, 40232, 40233, 40234

Typical Noise Characteristics for Type 40233



92CS-12601



40235 to 40240

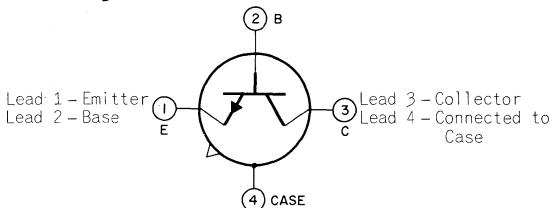
Transistors

SILICON N-P-N HIGH-FREQUENCY TYPES

For Tuner and IF-Amplifier Circuits in VHF TV Receivers

40235, 40236, 40237—For RF Amplifier, Mixer and Local Oscillator Respectively in Tuners Covering Channels 2-13
40238, 40239, 40240—For 45-Mc/s Picture IF Amplifiers

Dimensions See accompanying *Dimensional Outline*
 Terminal Diagram **BOTTOM VIEW**



ABSOLUTE MAXIMUM RATINGS

Type Nos. 40235 to 40240

Collector-to-Base Voltage

Emitter Open	V_{CB0}	35	V
$V_{EB} = 1V$	V_{CBV}	35	V

Emitter-to-Base Voltage.

V_{EB0}	3	V
-----------	---	---

Collector Current.

I_C	50	mA
-------	----	----

Transistor Dissipation

At free-air temperatures:

From -65 to 25°C	P_T	180	mW
Above 25°C	Derate linearly to 0 W at 175°C		

Temperature Range (Free-Air)

Operating.	$T_{(opr)}$	-65 to 175	$^\circ\text{C}$
Storage.	$T_{(stg)}$	-65 to 175	$^\circ\text{C}$

Lead-Soldering Temperature ^a	255	$^\circ\text{C}$
For 10 sec. max		

ELECTRICAL CHARACTERISTICS

Electrode voltage and electrode current values for given test conditions are dc at free-air temperature = 25°C

Collector-Cutoff Current

$V_{CB} = 1V$			
40235 thru 40240	I_{CB0}	0.02 max	μA

$V_{CB} = 35V$			
40235 thru 40240	I_{CB0}	1 max	μA

Emitter Cutoff Current

$V_{EB} = 1V$			
40236 thru 40240	I_{EB0}	1 max	μA

$V_{EB} = 3V$			
40235.	I_{EB0}	1 max	μA



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DATA 1
 9-65

40235 to 40240

DC Forward-Current Transfer Ratio

$V_{CE} = 6V$, $I_E = -1 \text{ mA}$

40235, 40236, 40238.	h_{FE}	40 min
40237, 40239, 40240.	h_{FE}	27 min
40235, 40238.	h_{FE}	170 max
40236, 40237, 40240.	h_{FE}	275 max
40239.	h_{FE}	100 max

Gain Bandwidth Product

$f = 100 \text{ Mc/s}$, $V_{CE} = 6V$, $I_E = -1 \text{ mA}$

40235, 40236, 40237.	f_T	1200 typ Mc/s
40238, 40239, 40240.	f_T	900 typ Mc/s

Collector-to-Base Feedback Capacitance

$f = 216 \text{ Mc/s}$, $V_{CE} = 10V$, $I_E = -2 \text{ mA}$

40235.	C_{cb}	0.5 typ	pF
----------------	----------	---------	----

$f = 216 \text{ Mc/s}$, $V_{CE} = 12V$, $I_E = -1.5 \text{ mA}$

40236.	C_{cb}	0.5 typ	pF
----------------	----------	---------	----

$f = 216 \text{ Mc/s}$, $V_{CE} = 12V$, $I_E = -3 \text{ mA}$

40238, 40239, 40240.	C_{cb}	0.5 typ	pF
------------------------------	----------	---------	----

Input Resistance

$f = 216 \text{ Mc/s}$, $V_{CE} = 10V$, $I_E = -2 \text{ mA}$

40235.	R_i	190 typ	Ω
----------------	-------	---------	----------

$f = 216 \text{ Mc/s}$, $V_{CE} = 12V$, $I_E = -1.5 \text{ mA}$

40236.	R_i	230 typ	Ω
----------------	-------	---------	----------

$f = 45 \text{ Mc/s}$, $V_{CE} = 12V$, $I_E = -3 \text{ mA}$

40238, 40239, 40240.	R_i	480 typ	Ω
------------------------------	-------	---------	----------

Output Resistance

$f = 216 \text{ Mc/s}$, $V_{CE} = 10V$, $I_E = -2 \text{ mA}$

40235.	R_o	8.9 typ	k Ω
----------------	-------	---------	------------

$f = 45 \text{ Mc/s}$, $V_{CE} = 12V$, $I_E = -1.5 \text{ mA}$

40236.	R_o	65 typ	k Ω
----------------	-------	--------	------------

$f = 45 \text{ Mc/s}$, $V_{CE} = 12V$, $I_E = -3 \text{ mA}$

40238, 40239, 40240.	R_o	35 typ	k Ω
------------------------------	-------	--------	------------

Extrinsic Transconductance

$f = 216 \text{ Mc/s}$, $V_{CE} = 10V$, $I_E = -2 \text{ mA}$

40235.	gm	43.7 typ	mmhos
----------------	----	----------	-------

$f = 45 \text{ Mc/s}$, $V_{CE} = 12V$, $I_E = -3 \text{ mA}$

40238, 40239, 40240.	gm	90 typ	mmhos
------------------------------	----	--------	-------

Noise Figure

$f = 216 \text{ Mc/s}$, $V_{CE} = 10V$, $I_E = -2 \text{ mA}$

40235.	NF	3.3 typ	dB
----------------	----	---------	----

Maximum Available Conversion Gain

$f = 216 \text{ to } 45 \text{ Mc/s}$, $V_{CE} = 12V$, $I_E = -1.5 \text{ mA}$

40236.	MAG_c	19 typ	dB
----------------	---------	--------	----

Output Capacitance (Open Circuit)

$f = 257 \text{ Mc/s}$, $V_{CB} = 12V$, $I_C = -2.5 \text{ mA}$

40238.	C_{ob}	0.6 max	pF
----------------	----------	---------	----

Maximum Available Amplifier Gain

$f = 216 \text{ Mc/s}$, $V_{CE} = 10V$, $I_E = -2 \text{ mA}$

40235.	MAG	29.1 typ	dB
----------------	-----	----------	----

$f = 45 \text{ Mc/s}$, $V_{CE} = 12V$, $I_E = -3 \text{ mA}$

40238, 40239, 40240	MAG	45.3 typ	dB
---------------------	-----	----------	----

For 1, 2, or 3 stages



40235 to 40240

Maximum Usable Amplifier Gain (Unneutralized)

$f = 45 \text{ Mc/s}$, $V_{CE} = 12 \text{ V}$, $I_E = -3 \text{ mA}$

40238, 40239, 40240

For 1 stage.	MUG	22.9 typ	dB
For 2 stages.	MUG	20.7 typ	dB
For 3 stages.	MUG	19 typ	dB

Maximum Usable Amplifier Gain (Neutralized)

$f = 216 \text{ Mc/s}$, $V_{CE} = 10 \text{ V}$, $I_E = -2 \text{ mA}$

40235^b MUG 18.1 typ dB

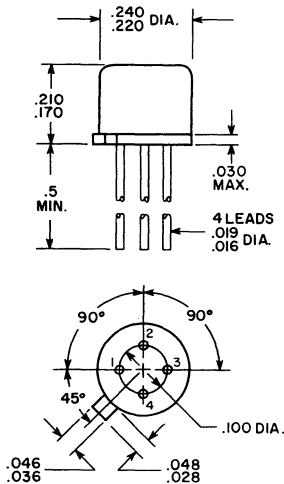
$f = 45 \text{ Mc/s}$, $V_{CE} = 12 \text{ V}$, $I_E = -3 \text{ mA}$

40238, 40239, 40240

For 1 stage.	MUG	28 typ	dB
For 2 stages.	MUG	25.8 typ	dB
For 3 stages.	MUG	24.1 typ	dB

- ^a Measured along lead at distances not less than $1/32''$ from seating surface.
^b See accompanying 216-Mc/s POWER GAIN AND NOISE FIGURE TEST CIRCUIT.

DIMENSIONAL OUTLINE



92CS-12916

DIMENSIONS IN INCHES



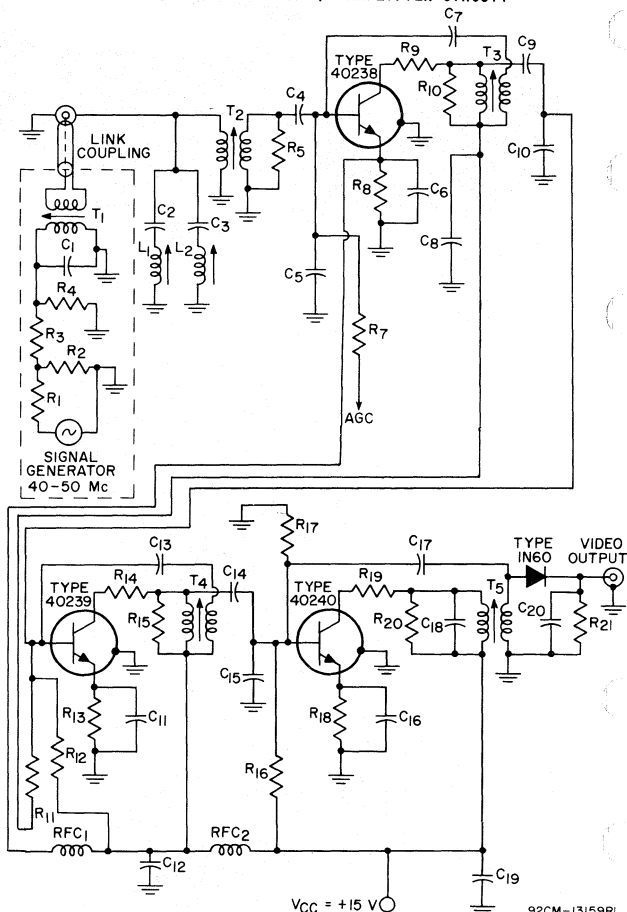
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DATA 2
9-65

40235 to 40240

TYPICAL 3-STAGE 43.5-Mc/s AMPLIFIER CIRCUIT



92CM-13159R1

C₁, C₉, C₁₄, C₂₀ = 10 pF
 C₂, C₃ = 12 pF
 C₄ = 13 pF
 C₅ = 180 pF
 C₆, C₈, C₁₁, C₁₂, C₁₆, =
 0.005 μF
 C₇ = 4.7 pF
 C₁₀ = 56 pF

C₁₃ = 6.8 pF
 C₁₅ = 120 pF
 C₁₇, C₁₈ = 1.2 pF
 C₁₉ = 0.01 μF
 R₁, R₂ = 50 Ω
 R₃ = 68,000 Ω
 R₄, R₅ = 18,000 Ω
 R₆, R₁₂, R₁₇ = 10 Ω

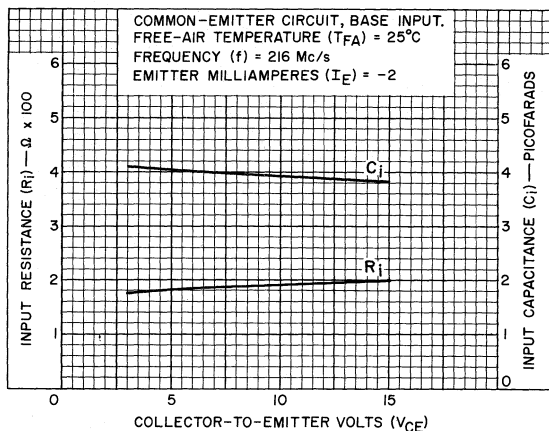
R₇, R₁₁, R₁₆ = 10,000 Ω
 R₈, R₁₃, R₁₈ = 1000 Ω
 R₉, R₁₄, R₁₉ = 47 Ω
 R₁₀, R₁₅ = 1800 Ω
 R₂₀ = 33 Ω
 R₂₁ = 4700 Ω
 RFC₁ = 10 μH
 RFC₂ = 10 μH



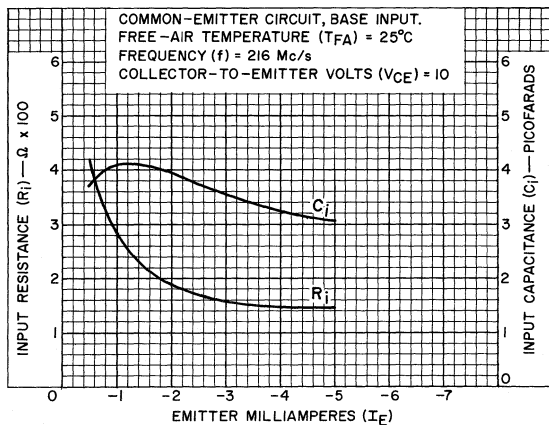
40235 to 40240

Typical Input Characteristics at 216 Mc/s

40235

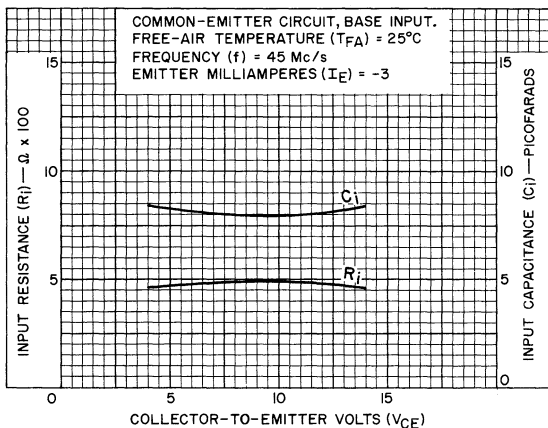


40235

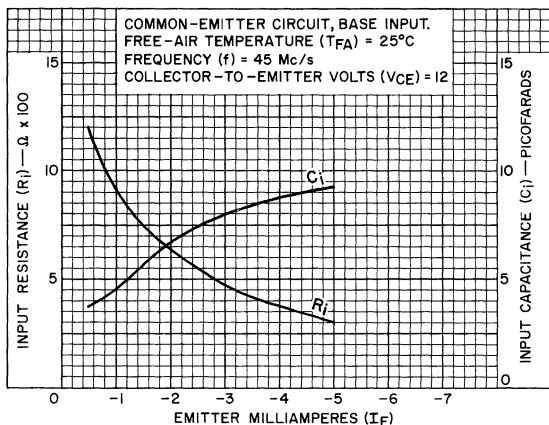


Typical Input Characteristics at 45 Mc/s

40238 40239 40240

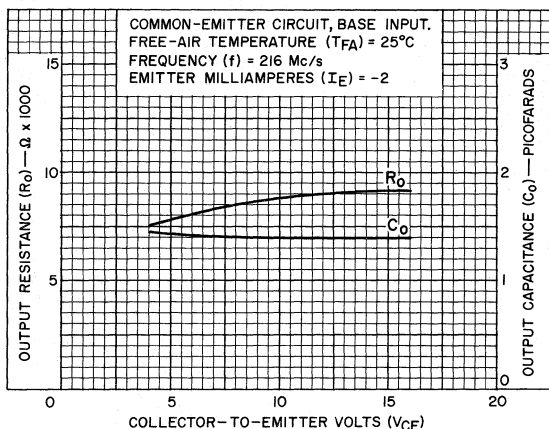


40238 40239 40240



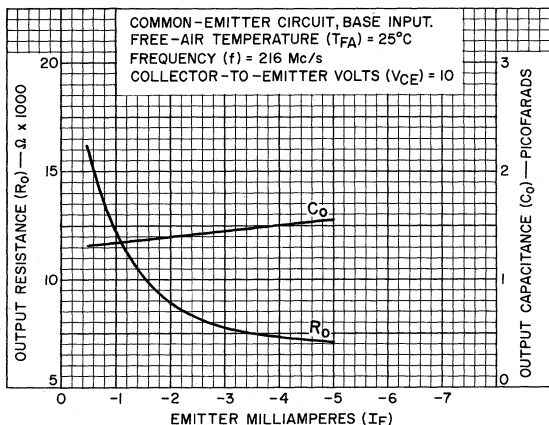
Typical Output Characteristics at 216 Mc/s

40235



92CS-13167

40235

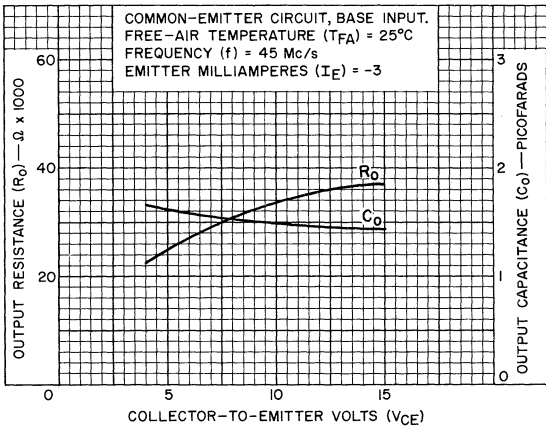


92CS-13166

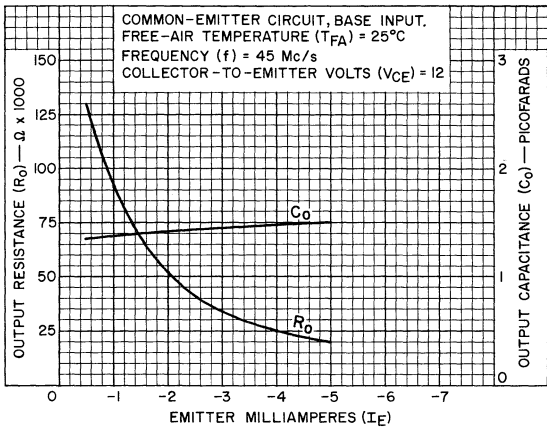


Typical Output Characteristics at 45 Mc/s

40238 40239 40240

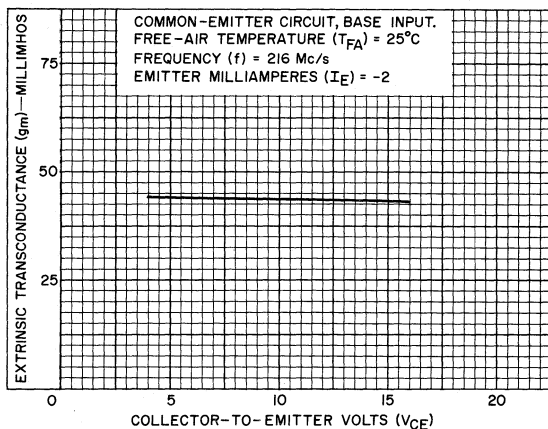


40238 40239 40240



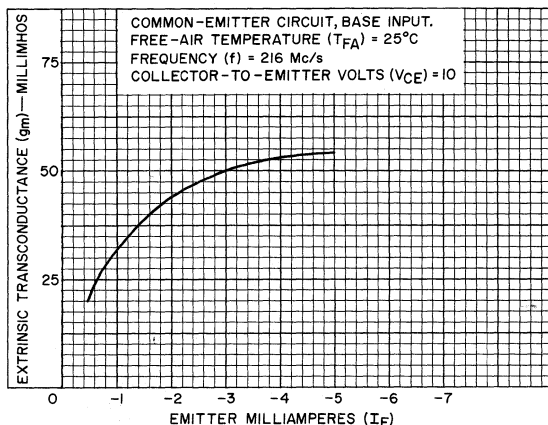
Typical Extrinsic-Transconductance
Characteristics at 216 Mc/s

40235



92CS-13164

40235

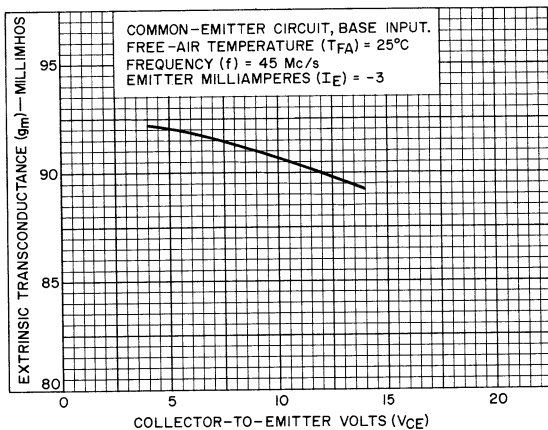


92CS-13165

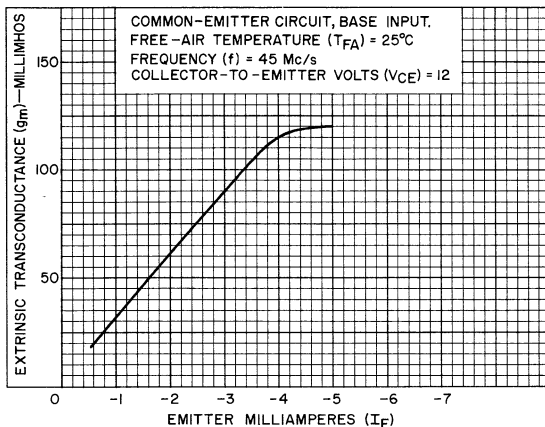


Typical Extrinsic-Transconductance Characteristics at 45 Mc/s

40238 40239 40240

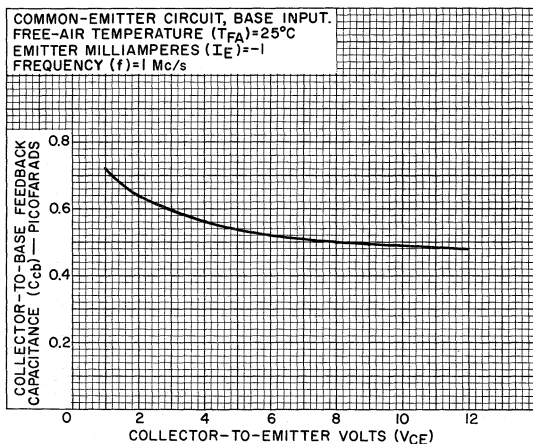


40238 40239 40240



Typical Feedback Capacitance Characteristics

40235 40236 40237 40238 40239 40240



92CS-13204



40242 to 40246

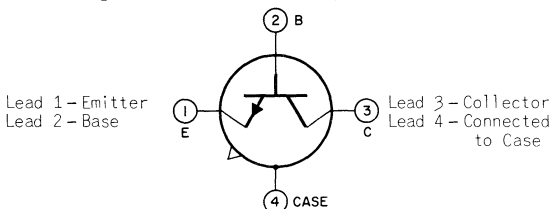
High Frequency Transistor Complement for FM & AM/FM Receivers

SILICON N-P-N PLANAR TYPES

For "Front-End" and IF-Amplifier Stages of FM and
AM/FM Receivers Operating at Frequencies to 110 Mc/s

40242 — RF Amplifier
40243 — Mixer
40244 — HF Oscillator
40245, 40246 — IF Amplifiers

Dimensions. See accompanying Dimensional Outline
Terminal Diagram BOTTOM VIEW



ABSOLUTE-MAXIMUM RATINGS

The following ratings apply to all types
listed above except where indicated otherwise

Collector-to-Base Voltage	V_{CB0}	35	V
Collector-to-Base Voltage	V_{CBV}	35	V
$V_{EB} = 1 \text{ V}$			
Emitter-to-Base Voltage			
40242	V_{EB0}	5	V
40243, 40244, 40245, 40246.	V_{EB0}	3	V
Collector Current	I_C	50	mA
Transistor Dissipation			
At free-air temperatures:			
From -65° to 25° C.	P_T	180	mW
Above 25° C.	Derate linearly to 0 W at 175° C		
Temperature Range			
Operating	$T_{FA}(\text{opr})$	-65 to 175	$^{\circ}\text{C}$
Storage	$T_{FA}(\text{stg})$	-65 to 175	$^{\circ}\text{C}$
Lead-Soldering Temperature ^a		255	$^{\circ}\text{C}$
For 10 sec. max			



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Electronic Components and Devices Harrison, N. J.

DATA 1
9-65

40242 to 40246

ELECTRICAL CHARACTERISTICS

Electrode voltage and electrode current values for given test conditions are dc at free-air temperature = 25° C.

The following characteristic values apply to all types listed above except where indicated otherwise

	Min	Typ	Max	
Collector-to-Base Breakdown Voltage				
$I_C = 0.001 \text{ mA}$	BV_{CB0}	35	-	- V
$V_{EB} = -1 \text{ V}$	BV_{CBV}	35	-	- V
Emitter-to-Base Breakdown Voltage BV_{EB0}				
$I_E = -0.001 \text{ mA}$		3	-	- V
Collector-Cutoff Current I_{CB0}				
$V_{CE} = 1 \text{ V}, I_E = 0$		-	-	0.02 μA
Emitter-Cutoff Current				
$V_{EB} = 5 \text{ V}$				
40242	I_{EB0}	-	-	1 μA
$V_{EB} = 3 \text{ V}$				
40243, 40244, 40245, 40246	I_{EB0}	-	-	1 μA
DC Forward-Current Transfer Ratio				
$V_{CE} = 6 \text{ V}, I_E = -1 \text{ mA}$				
40242, 40243	h_{FE}	40	80	170
40244	h_{FE}	27	65	170
40245	h_{FE}	70	120	170
40246	h_{FE}	27	55	90
Feedback Capacitance				
$f = 1 \text{ Mc/s}, V_{CE} = 8 \text{ V}, I_E = 0$				
40242, 40243, 40245, 40246	C_{ob}	-	0.5	0.65 pF
40244	C_{ob}	-	0.6	0.8 pF
Input Resistance				
$f = 100 \text{ Mc/s}, V_{CE} = 7.5 \text{ V}, I_E = -1.5 \text{ mA}$				
40242	R_{IN}	-	450	- Ω
$f = 100 \text{ Mc/s}, V_{CE} = 7.5 \text{ V}, I_E = -1 \text{ mA}$				
40243	R_{IN}	-	650	- Ω
$f = 10.7 \text{ Mc/s}, V_{CE} = 7.5 \text{ V}, I_E = -2 \text{ mA}$				
40245	R_{IN}	-	1400	- Ω
40246	R_{IN}	-	1200	- Ω
Output Resistance				
$f = 100 \text{ Mc/s}, V_{CE} = 7.5 \text{ V}, I_E = -1.5 \text{ mA}$				
40242	R_{OUT}	-	30000	- Ω
$f = 100 \text{ Mc/s}, V_{CE} = 7.5 \text{ V}, I_E = -1 \text{ mA}$				
40243	R_{OUT}	-	30000	- Ω
$f = 10.7 \text{ Mc/s}, V_{CE} = 7.5 \text{ V}, I_E = -2 \text{ mA}$				
40245	R_{OUT}	-	80000	- Ω
40246	R_{OUT}	-	90000	- Ω
Input Capacitance				
$f = 100 \text{ Mc/s}, V_{CE} = 7.5 \text{ V}, I_E = -1.5 \text{ mA}$				
40242	C_{IN}	-	5.2	- pF
$f = 100 \text{ Mc/s}, V_{CE} = 7.5 \text{ V}, I_E = -1 \text{ mA}$				
40243	C_{IN}	-	4.5	- pF
$f = 10.7 \text{ Mc/s}, V_{CE} = 7.5 \text{ V}, I_E = -2 \text{ mA}$				
40245, 40246	C_{IN}	-	8.2	- pF



40242 to 40246

Min Typ Max

Output Capacitance

f = 100 Mc/s, VCE = 7.5 V, IE = -1.5 mA				
40242	C _{OUT}	-	1.35	- pF
f = 100 Mc/s, VCE = 7.5 V, IE = -1 mA				
40243	C _{OUT}	-	1.35	- pF
f = 10.7 Mc/s, VCE = 7.5 V, IE = -2 mA				
40245, 40246	C _{OUT}	-	1.5	- pF

Extrinsic Transconductance

f = 100 Mc/s, VCE = 7.5 V, IE = -1.5 mA				
40242	gm	-	45	- pmhos
f = 100 Mc/s, VCE = 7.5 V, IE = -1 mA				
40243	gm	-	32	- pmhos
f = 10.7 Mc/s, VCE = 7.5 V, IE = -2 mA				
40245, 40246	gm	-	70	- pmhos

Noise Figure^b

f = 100 Mc/s, Rg = 300 Ω				
40242	NF	-	2.5	- dB

Oscillator Output Voltage^c

f = 120 Mc/s				
40244	V _{OUT}	-	55	- mV

Maximum Available Amplifier Gain

f = 100 Mc/s, VCE = 7.5 V, IE = -1.5 mA				
40242	MAG	-	38.3	- dB
f = 10.7 Mc/s, VCE = 7.5 V, IE = -2 mA				
40245	MAG	-	51.4	- dB
40246	MAG	-	51.2	- dB

Maximum Available Conversion Gain

f = 100 to 10.7 Mc/s, VCE = 7.5 V, IE = -1 mA				
40243	MAG _C	-	37.64	- dB

Maximum Usable Amplifier Gain

(Neutralized)

f = 100 Mc/s, VCE = 7.5 V, IE = -1.5 mA				
40242	MUG	-	21.5	- dB
f = 10.7 Mc/s				
40245, 40246 ^d				
For 1 stage	MUG	-	33.2	- dB
For 2 stages	MUG	-	31	- dB
For 3 stages	MUG	-	29.2	- dB
For 4 stages	MUG	-	28.5	- dB

Maximum Usable Amplifier Gain

(Unneutralized)

f = 100 Mc/s				
40242 ^b	MUG	-	16.4	- dB
f = 10.7 Mc/s, VCE = 7.5 V, IE = -2 mA				
40245, 40246				
For 1 stage	MUG	-	28.1	- dB
For 2 stages	MUG	-	25.9	- dB
For 3 stages	MUG	-	24.1	- dB
For 4 stages	MUG	-	23.4	- dB



40242 to 40246

- ^a Measured along lead at distances not less than 1/32" from seating surface.
- ^b See accompanying 100-Mc/s Power Gain and Noise Figure Test Circuit (40242).
- ^c See accompanying 120-Mc/s Oscillator Voltage Output Test Circuit (40244).
- ^d See accompanying 10.7-Mc/s Neutralized Amplifier Power Gain Measurement Circuit (40245, 40246).

OPERATING CONSIDERATIONS

The *flexible leads* of the 40242 to 40246 are usually soldered to the circuit elements. It is desirable in all soldering operations to provide some slack or an expansion elbow in the leads, to prevent excessive tension on the leads. It is important during the soldering operation to avoid excessive heat in order to prevent possible damage to the devices. To absorb some of the heat, grip the flexible lead of the device between the case and the soldering point with a pair of pliers.

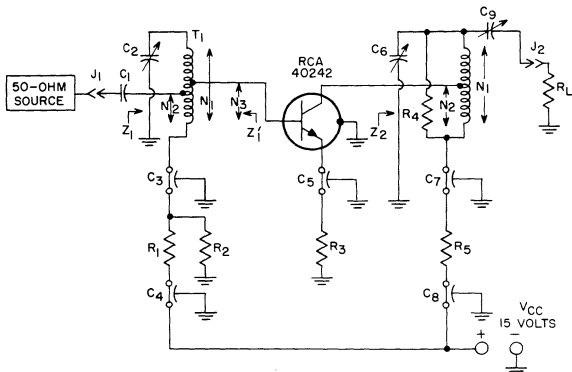
For Additional Information on these Transistor Types, write for Technical Bulletin "High-Frequency Transistors for FM and AM/FM Receivers — 40242-40246", available from:

Commercial Engineering
Electronic Components and Devices
Radio Corporation of America
Harrison, New Jersey



100-Mc/s POWER GAIN AND NOISE FIGURE TEST CIRCUIT

40242



92CS-12945RI

- C_1 : 50 pF silver mica type
 C_2, C_6 : 2.8-17.5 pF, variable, Hammarlund Type HF-15 or equivalent
 C_3, C_4, C_5, C_7, C_8 : 1500 pF, feedthrough type
 C_9 : 0.7-3 pF tubular trimmer, Erie Type 535 4R or equivalent (See T2)

J_1, J_2 : BNC-type coaxial connector, for 50 Ω termination

- R_1 : 3900 $\Omega \pm 1\%$, 0.25 W
 R_2 : 39000 Ω , 0.25 W
 R_3 : 330 $\Omega \pm 1\%$, 0.25 W
 R_4 : 27000 $\Omega \pm 5\%$, 0.5 W (See T2)
 R_5 : 4700 $\Omega \pm 1\%$, 0.5 W

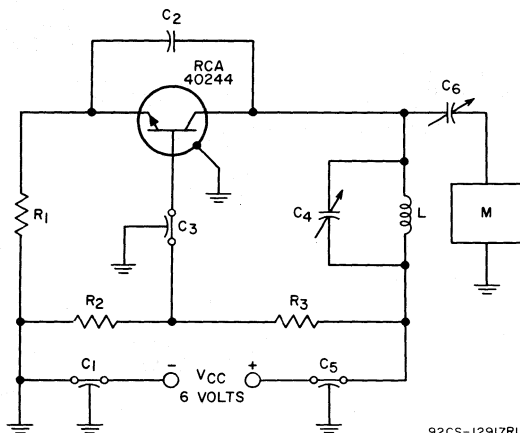
- T_1 : 4 turns B & W Type 3002 Miniductor or equivalent. $Q_o = 280$, $Q_L = 28$
 $N_1/N_2 = 5.6$ (Adjusted for $Z_1 = 250 \Omega$ with no secondary termination)
 $N_2/N_3 = 0.31$ (Adjusted for $Z'_1 = 1795 \Omega$ with no primary termination)
 $Z_1 = 50 \Omega$ when secondary is terminated with 450 Ω in parallel with 5.2 pF
 $Z'_1 = 300 \Omega$ when primary is terminated with 50 Ω

- T_2 : 4 turns B & W Type 3002 Miniductor or equivalent. Q_o (with $R_4 = 27000 \Omega$) = 80, $Q_L = 39.6$
 $N_1/N_2 = 10.35$ (Adjusted for $Z_2 = 243 \Omega$ with no secondary termination)
 $Z_2 = 121 \Omega$ with $C_9 = 1.67$ pF and secondary terminated with 50 Ω



40242 to 40246

120-Mc/s OSCILLATOR VOLTAGE OUTPUT TEST CIRCUIT 40244



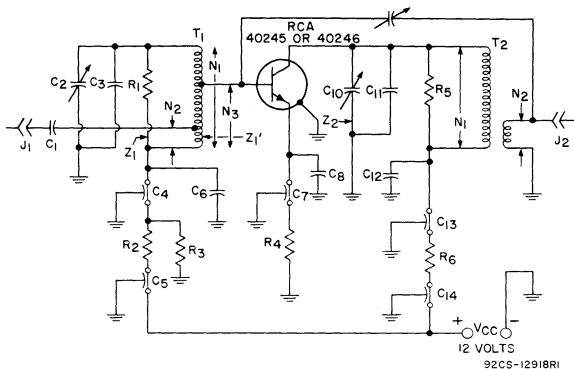
92CS-12917R1

- C₁, C₅: Feedthrough capacitors, 1500 pF
 C₂: 3.3 pF, tubular ceramic type
 C₃: Feedthrough capacitor, 1000 pF guaranteed minimum value
 C₄: Trimmer Capacitor, 3-35 pF, Arco Type 403 or equivalent
 C₆: Ceramic capacitor, 1.6 pF
 L: 4 turns B&W Type 3002 Miniductor or equivalent
 M: RF voltmeter, 50 Ω input impedance, Boonton Model 91D with 50- Ω adapter, or equivalent
 R₁: 1200 $\pm$ 10% Ω , 0.25 W
 R₂: 10000 $\pm$ 10% Ω , 0.25 W
 R₃: 47000 $\pm$ 10% Ω , 0.25 W
 R_L: Load, 50 Ω



10.7-Mc/s NEUTRALIZED AMPLIFIER POWER GAIN
MEASUREMENT CIRCUIT

40245 40246



C_1, C_6, C_8, C_{12} : 0.05 μ F, ceramic disc type

C_2, C_{10} : 3.7-52 pF, Harrarlund Type HF-50 or equivalent

C_3 : 560 pF, mica

$C_4, C_5, C_7, C_{13}, C_{14}$: 1500 pF,

feedthrough type

C_9 : 1.5-20 pF, variable

J_1, J_2 : Type BNC connector for 50- Ω coaxial cable

R_1 : 2400 Ω approx. (See T_1)

R_2 : 16000 Ω , 0.5 W

R_3 : 1800 $\Omega \pm 1\%$, 0.5 W

R_4 : 240 $\Omega \pm 1\%$, 0.5 W

R_5 : 24000 Ω approx. (See T_2)

TRANSFORMER DATA

	T_1	T_2
Winding	6 turns B & W No.3006 Mini-inductor, or equivalent	Primary: 35 turns Secondary: 3 turns approx. wound over supply end of primary. #30 "Grip-Eze" or equivalent wire on 1/4"-dia. form
N_1/N_2	5.2	-
N_2/N_3	0.561	-
Q_0	60 (shunted by R_1)	41.4 (shunted by R_5)
Q_L	26.25	18.2
Z_1	57.1 Ω with secondary unterminated; 50 Ω with secondary terminated in 1250 Ω in parallel with 8.3 pF	-
Z'_1	179 Ω with primary unterminated	-
Z_2	-	5750 Ω with secondary terminated in 50 Ω

* Trade Mark, Phelps-Dodge Copper Products Co.



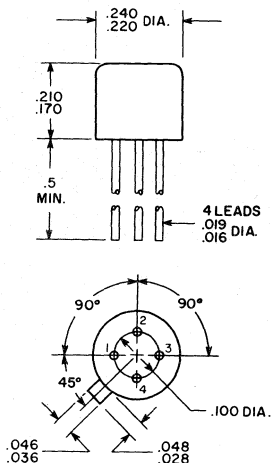
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9-65

40242 to 40246

DIMENSIONAL OUTLINE (40242 to 40246)

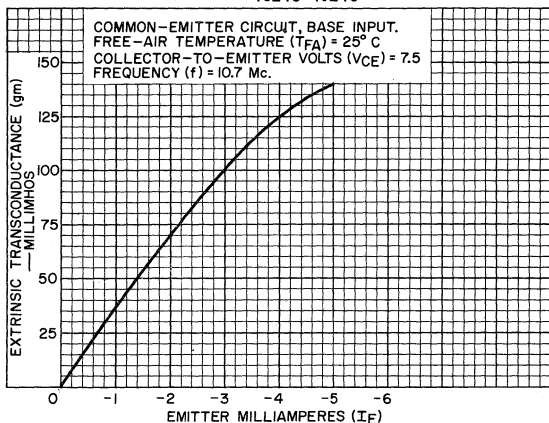


92CS-13180

DIMENSIONS IN INCHES

Typical Extrinsic-Transconductance Characteristic

40245 40246

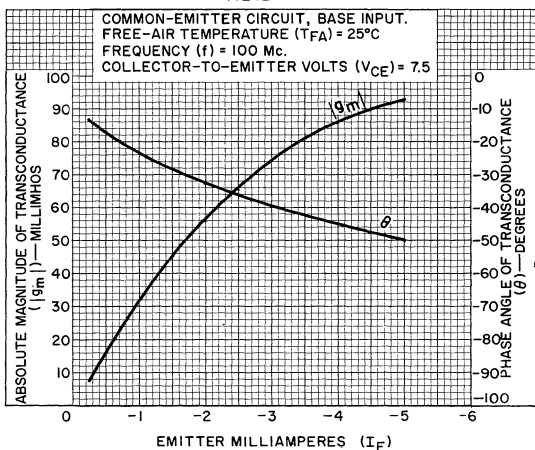


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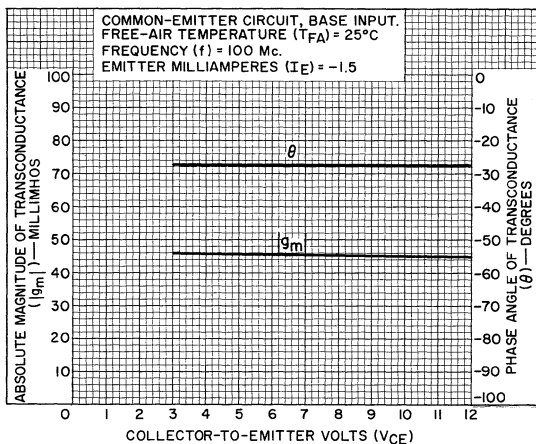


Typical Transconductance Characteristics at 100 Mc/s

40242



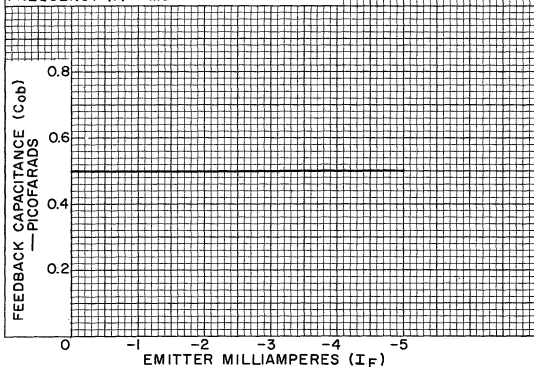
40242



Typical Feedback-Capacitance Characteristic

40242 40243 40245 40246

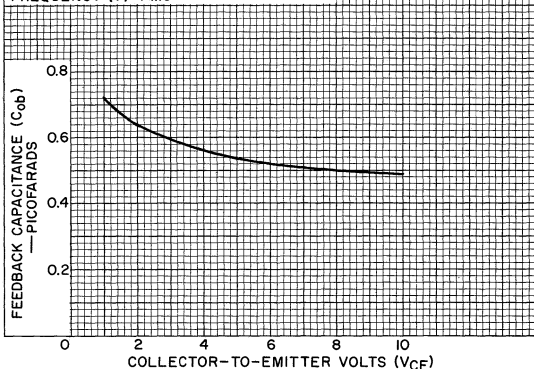
COMMON-EMITTER CIRCUIT, BASE INPUT.
FREE-AIR TEMPERATURE (T_{FA}) = 25° C
COLLECTOR-TO-EMITTER VOLTS (V_{CE}) = 7.5
FREQUENCY (f) = 1 Mc



92CS-12941

40242 40243 40245 40246

COMMON-EMITTER CIRCUIT, BASE INPUT.
FREE-AIR TEMPERATURE (T_{FA}) = 25° C
EMITTER MILLIAMPERES (I_E) = -1
FREQUENCY (f) = 1 Mc

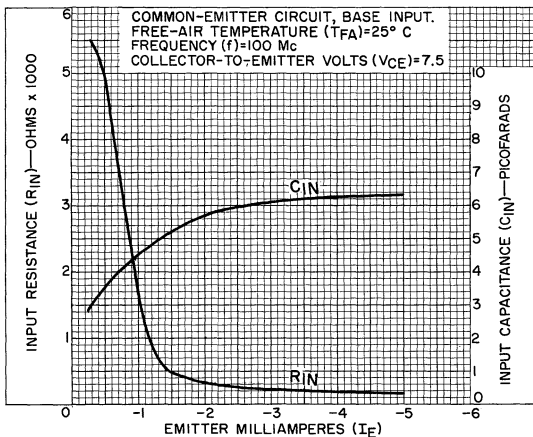


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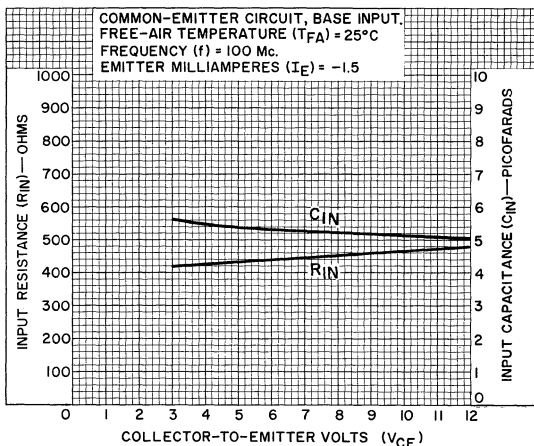
Typical Input Characteristics at 100 Mc/s

40242 40243



92CS-12944

40242 40243



92CS-12920



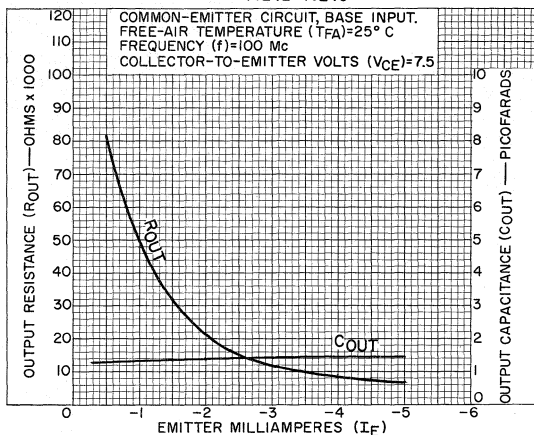
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 9-65

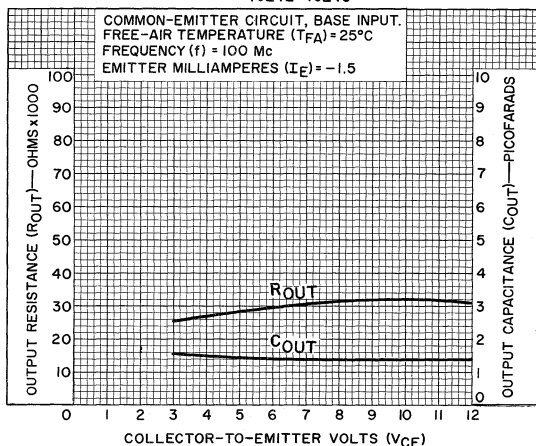
Typical Output Characteristics at 100 Mc/s

40242 40243



92CS-12940

40242 40243

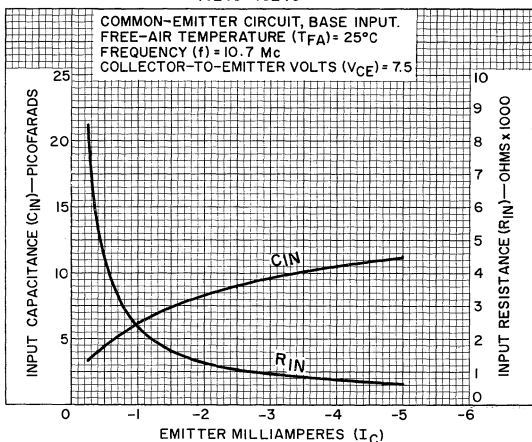


92CS-12928

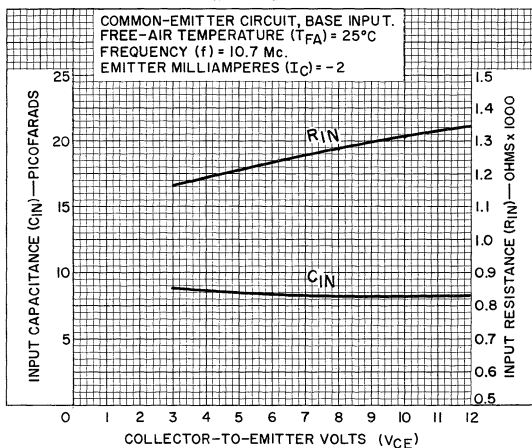


Typical Input Characteristics at 10.7 Mc/s

40245 40246



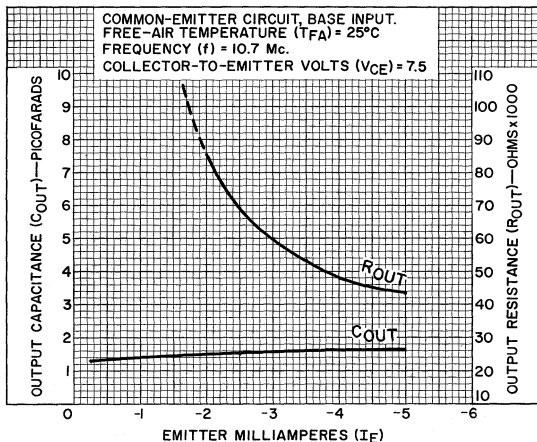
40245 40246



40242 to 40246

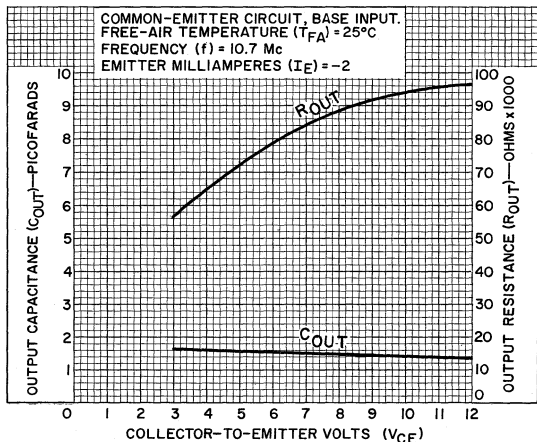
Typical Output Characteristics at 10.7 Mc/s

40245 40246



92CS-12926

40245 40246



92CS-12925



Power Transistors

SILICON N-P-N DIFFUSED TYPE

SMALL "TO-3" TYPE PACKAGE—40250

TO-3 PACKAGE—40251

For Audio and Inverter Circuits in Auto-Radio and Portable
Communications Equipment Operating from a 12-Volt Supply

Mechanical:

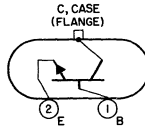
Dimensions:

40250. See accompanying *Dimensional Outline*40251. See *Outline TO-3* in General Section

Terminal Diagram

BOTTOM VIEW

Pin 1—Base
Pin 2—Emitter



Mounting Flange—
Collector,
Case

Maximum Ratings, Absolute-Maximum Values:

		40250	40251
Collector-to-Base Voltage. . .	V_{CBO}	50	50 max. volts
With emitter open			
Collector-to-Emitter Voltage			
With reverse bias $V_{EB} =$			
1.5 volts.	V_{CEV}	50	50 max. volts
With base open (Sustain-			
ing voltage)	$V_{CEO(sus)}$	40	40 max. volts
Emitter-to-Base Voltage. . .	V_{EBO}	5	5 max. volts
With collector open			
Collector Current.	I_C	4	15 max. amp
Base Current	I_B	2	7 max. amp
Transistor Dissipation			
At case temperatures			
From -65° to 25° C	P_T	29	117 max. watts
Above 25° to 200° C			
40250.		Derate linearly 0.166 watt/ $^{\circ}$ C	
40251.		Derate linearly 0.668 watt/ $^{\circ}$ C	
Temperature			
Operating range (Junction) .	T_{opr}	-65 to 200	$^{\circ}$ C
Storage.	T_{stg}	-65 to 200	$^{\circ}$ C
Pin-Soldering Temperature ^a . .	T_p	235	235 max. $^{\circ}$ C
(For 10 sec. max.)			

^a Measured along pin at distances not less than 1/32" from seating plane.



40250, 40251

ELECTRICAL CHARACTERISTICS

Case temperature = 25° C, unless otherwise specified

		40250		40251		
		min.	max.	min.	max.	
DC Collector-to-Base						
Breakdown Voltage						
$I_C = 50$ ma., $I_E = 0$	BV_{CBO}	50	-	-	-	volts
$I_C = 100$ ma., $I_E = 0$	BV_{CBO}	-	-	50	-	volts
DC Collector-to-Emitter						
Breakdown Voltage						
$I_C = 50$ ma., reverse bias						
$V_{EB} = 1.5$ volts. . . .	BV_{CEV}	50	-	-	-	volts
$I_C = 100$ ma., reverse						
bias $V_{EB} = 1.5$ volts .	BV_{CEV}	-	-	50	-	volts
$I_C = 100$ ma., $I_B = 0$						
(Sustaining voltage). $BV_{CEO(sus)}$		40	-	-	-	volts
$I_C = 200$ ma., $I_B = 0$						
(Sustaining voltage). $BV_{CEO(sus)}$		-	-	40	-	volts
DC Emitter-to-Base						
Breakdown Voltage						
$I_E = 5$ ma., $I_C = 0$	BV_{EBO}	5	-	-	-	volts
$I_E = 10$ ma., $I_C = 0$	BV_{EBO}	-	-	5	-	volts
DC Base-to-Emitter Voltage						
$V_{CE} = 4$ volts, $I_C = 1.5$						
amperes	V_{BE}	-	2.2	-	-	volts
$V_{CE} = 4$ volts, $I_C = 8$						
amperes	V_{BE}	-	-	-	2.2	volts
DC Collector-to-Emitter						
Saturation Voltage						
$I_C = 1.5$ amperes,						
$I_B = 150$ ma.	$V_{CE(sat)}$	-	1.5	-	-	volts
$I_C = 8$ amperes,						
$I_B = 800$ ma.	$V_{CE(sat)}$	-	-	-	1.5	volts
DC Collector-Cutoff						
Current						
$V_{CB} = 30$ volts, $I_E = 0$. .	I_{CBO}	-	1	-	5	ma
$V_{CB} = 30$ volts, $I_E = 0$,						
$T_C = 150^\circ$ C.	I_{CBO}	-	5	-	10	ma
DC Emitter-Cutoff Current	I_{EBO}	-	5	-	10	ma
$V_{EB} = 5$ volts, $I_C = 0$						
DC Forward-Current Trans-						
fer Ratio						
$V_{CE} = 4$ volts, $I_C = 1.5$						
amperes	h_{FE}	25	100	-	-	
$V_{CE} = 4$ volts, $I_C = 8$						
amperes	h_{FE}	-	-	15	60	
Thermal Resistance. . . .	θ_{JC}	-	6	-	1.5	$^\circ\text{C}/\text{w}$
Junction-to-case						



OPERATING CONSIDERATIONS

These transistors can be installed in commercially available sockets.

It is important that the mounting flange which serves as the collector terminal be securely fastened to a heat sink.

In applications where the chassis is connected to the positive terminal of the voltage supply, it will be necessary to use an anodized-aluminum insulator having high thermal conductivity, or a 0.002" mica insulator between the mounting flange and the chassis. The insulator should extend beyond the mounting-flange. An aluminum washer should be drilled or punched to provide the two mounting holes, and the clearance holes for the emitter and base pins. The burrs should then be removed from the washer and the washer finally anodized. To insure that the anodized insulating layer is not destroyed during mounting, it will also be necessary to remove the burrs from the holes in the chassis. Furthermore, to prevent a short circuit between the mounting bolt and the chassis, it is important that a fiber washer be used between the bolt and the chassis. See *Suggested Mounting Arrangement*.

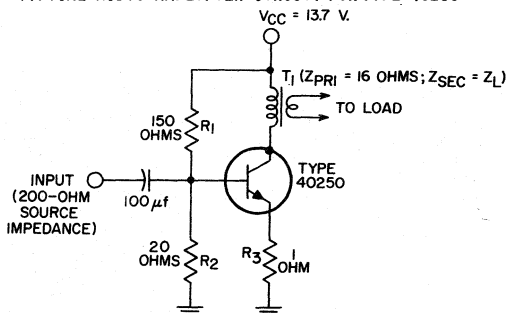
It is to be noted that the case of these transistors operate at the collector voltage. Because of the possibility of shock hazard, when the cases of these transistors are at a voltage appreciably above or below ground potential, suitable precautionary measures should be taken.

Information furnished by RCA is believed to be accurate and reliable. However, no responsibility is assumed by RCA for its use; nor for any infringements of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of RCA.



40250, 40251

TYPICAL AUDIO-AMPLIFIER CIRCUIT FOR TYPE 40250

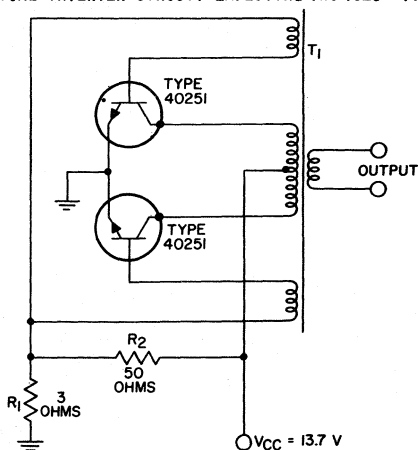


92CS-12562

For $P_o = 4$ watts; 6.5% distortion

For $P_o = 0.4$ watt at $f = 1$ kc, 2% distortion

TYPICAL INVERTER CIRCUIT EMPLOYING TWO 40251 TYPES

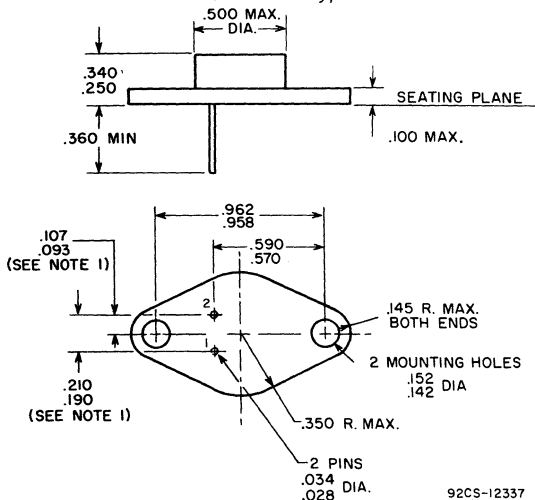


92CS-12563

Circuit Efficiency: (For power input of 110 watts and frequency of 3.5 kc) -82%

T_1 : Core--toroid, 3" outside diameter, 1/2" x 1" cross section (Allen-Bradley) (T3000H 106B) RO-3 material or equivalent. Primary--16 turns, No.20 wire, center tap. Feedback winding--8 turns, No.22 wire, center tap.

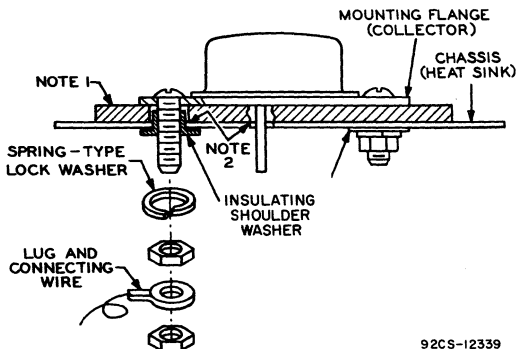
Dimensional Outline for Type 40250



DIMENSIONS IN INCHES

Note 1: These dimensions should be measured at points .050 to .055 below seating plane. When gauge is not used, measurement will be made at seating plane.

SUGGESTED MOUNTING ARRANGEMENT For 40250 & 40251



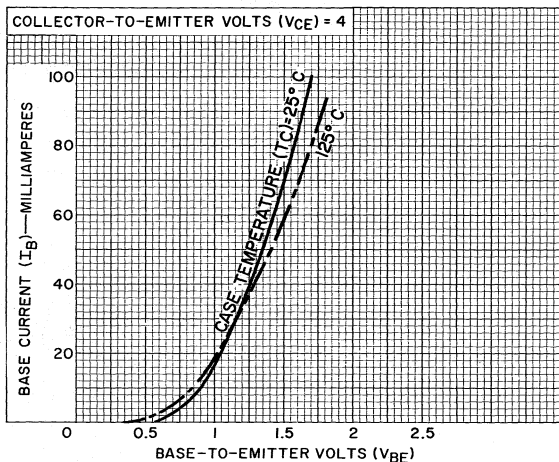
Note 1: 0.002" mica insulator or anodized aluminum insulator (drilled or punched with burrs removed).

Note 2: Remove burrs from chassis holes.



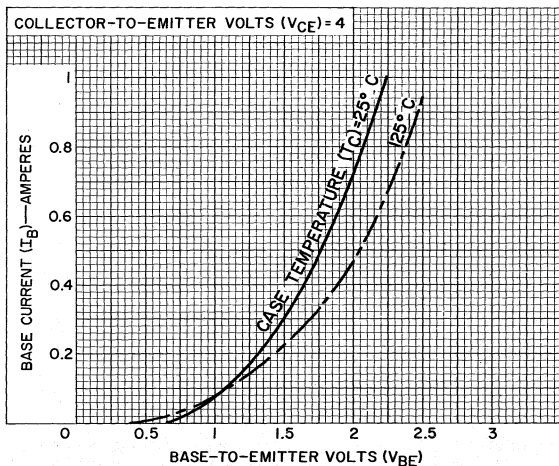
40250, 40251

Typical Base (Input) Characteristics 40250



92CS-12305

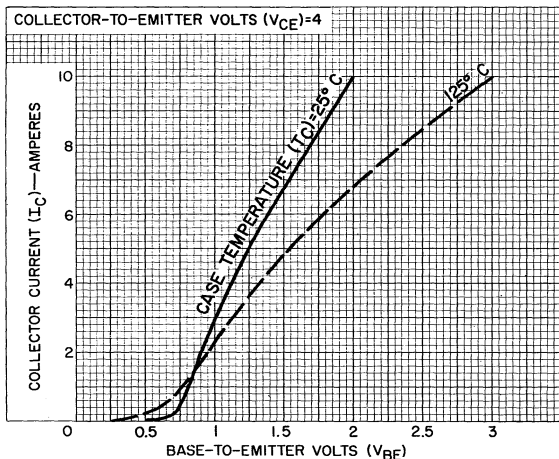
40251



92CS-12307

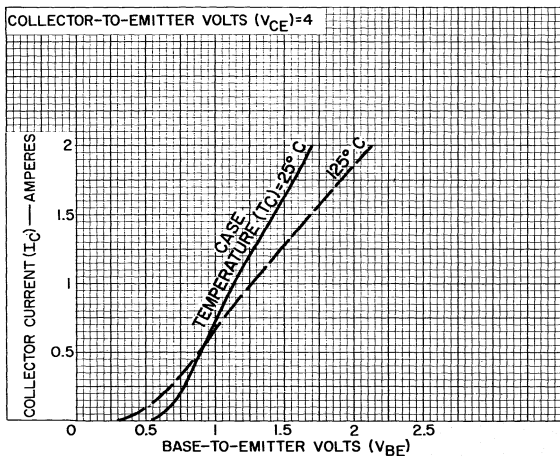


Typical Transfer Characteristics 40250



92CS-12326

40251

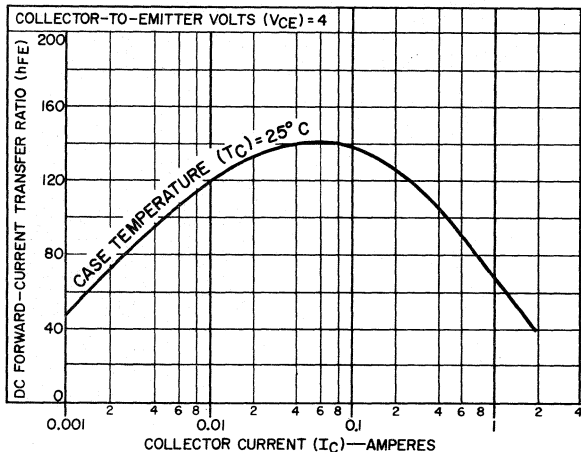


92CS-12325

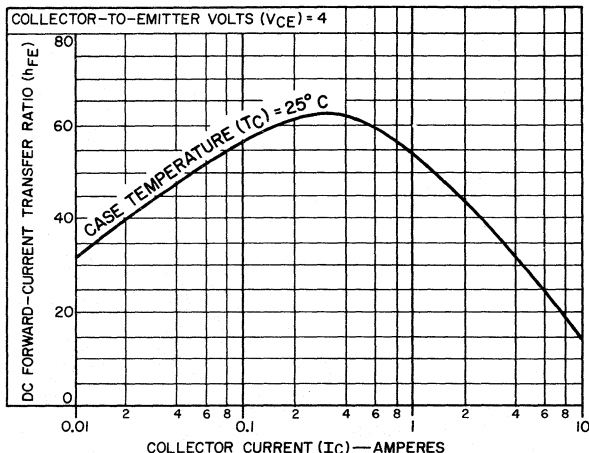


40250,40251

Typical DC Forward-Current Transfer-Ratio Characteristics 40250



40251



Power Transistor

SILICON N-P-N DIFFUSED TYPE

T0-66 PACKAGE WITH ATTACHED HEAT RADIATOR

(Tabs Provided on Underside of Radiator for
Printed-Circuit Board Mounting)*For Audio and Inverter Circuits in 12-Volt Mobile Radio and
Portable Communications Equipment. This Type Intended for
Applications Requiring a Rugged Transistor for Mounting
on Printed-Circuit Board.**The 40250V1 is the same as the 40250 except for the following items:*

ABSOLUTE MAXIMUM RATINGS

Transistor Dissipation

At free-air temperatures:

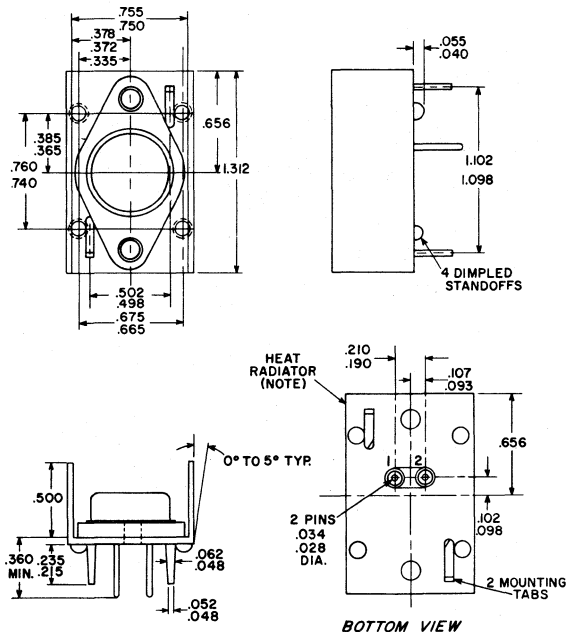
From -65° to 25° C	P_T	5.8	W
Above 25° C	Derate linearly 0.033 W/°C		

ELECTRICAL CHARACTERISTICS

Thermal Resistance	θ_{JFA}	30 max	°C/W
Junction-to-free-air			



DIMENSIONAL OUTLINE



92CS-13383

DIMENSIONS IN INCHES

Note: 0.035 C.R.S., tin plated.

Transistor

GERMANIUM P-N-P ALLOY TYPE

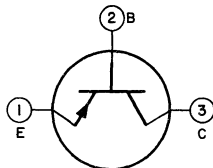
For Class B AF-Amplifier Applications in
Consumer-Product and Industrial Equipment

Mechanical:

Dimensions. See Outline TO-1 in General Section

Terminal Diagram: BOTTOM VIEW

Lead 1 - Emitter
Lead 2 - Base



Lead 3 - Collector

Maximum Ratings, Absolute-Maximum Values:

Collector-to-Base Voltage	V_{CBO}	-25	volts
Collector-to-Emitter Voltage.	V_{CEO}	-25	volts
Emitter-to-Base Voltage	V_{EBO}	-2.5	volts
Collector Current	I_C	-500	ma
Emitter Current	I_E	500	ma
Base Current.	I_B	-100	ma

Transistor Dissipation

At case temperatures:^a

From -65° to 64° C.	P_T	650 ^b	mw
Above 64° C.	Derate linearly	25.0 mw/°C	

At free-air temperatures:

From -65° to 55° C.	P_T	125	mw
Above 55° C.	Derate linearly	3.571 mw/°C	

Temperature Range

Operating (Junction).	T_{opr}	-65 to 90	°C
Storage	T_{stg}	-65 to 90	°C

Lead-Soldering Temperature ^c	T_L	255	°C
(For 10 sec. max.)			

ELECTRICAL CHARACTERISTICS

Unless otherwise specified, electrode-voltage
and electrode-current values for given test
conditions are dc at case temperature^a = 25° C.

Min. Typ. Max.

Collector-to-Base Breakdown

Voltage	BV_{CBO}	-25	-	-	volts
$I_C = -0.05$ ma, $I_E = 0$					

Collector-to-Emitter

Breakdown Voltage	BV_{CEO}	-25	-	-	volts
$I_C = -2$ ma, $I_B = 0$					



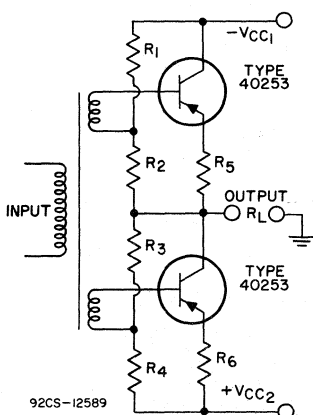
		Min.	Typ.	Max.	
Emitter-to-Base Breakdown					
Voltage.	BV_{EBO}	-2.5	-	-	volts
$I_E = 0.014$ ma, $I_C = 0$					
Base-to-Emitter Voltage					
$V_{CE} = -10$ volts, $I_C = -5$ ma.	V_{BE}	-	-0.15	-	volt
$V_{CE} = -1$ volt, $I_C = -400$ ma.	V_{BE}	-	-0.45	-	volt
Collector-to-Emitter					
Saturation Voltage.	$V_{CE(sat)}$	-	-0.5	-	volt
$I_C = -400$ ma, $I_B = -20$ ma					
Collector-Cutoff Current. . .	I_{CBO}	-	-	-14	μ a
$V_{CB} = -12$ volts, $I_E = 0$					
Emitter-Cutoff Current. . . .	I_{EBO}	-	-	-14	μ a
$V_{EB} = -2.5$ volts, $I_C = 0$					
DC Forward-Current					
Transfer Ratio.	h_{FE}	50	75	-	
$V_{EC} = -1$ volt, $I_C = -400$ ma					
Gain Bandwidth Product. . . .	f_T	-	1	-	Mc
Thermal Resistance.	θ_{JC}	-	-	40	$^{\circ}\text{C}/\text{w}$
Junction-to-case					

^a Measured on case perimeter at junction with seating surface.

^b This dissipation rating may be exceeded for measurements of music-power output at a free-air temperature of 25°C , using a regulated power supply (see EIA Standard RS-234-A).

^c Measured along lead at distance not less than $1/32"$ from seating plane.

TYPICAL CLASS B PUSH-PULL OUTPUT-STAGE CIRCUIT



$R_1, R_3 = 270$ ohms
 $R_2, R_4 = 3.9$ ohms
 $R_5, R_6 = 0.51$ ohm
 $R_L =$ Load (speaker voice-coil)
 impedance = 20 ohms

$V_{CC1}, V_{CC2} =$ DC collector
 supply voltages
 = 11 volts*

Zero-signal DC collector
 current = -5 ma

Zero-signal base-bias
 voltage = -0.15 volt

Peak collector current at
 maximum power output = -500 ma

Average collector current at
 maximum power output = -159 ma

Input impedance of stage (per
 base) = 100 ohms

Power gain (typical) = 32 db

Maximum collector dissipation
 = 600 mw

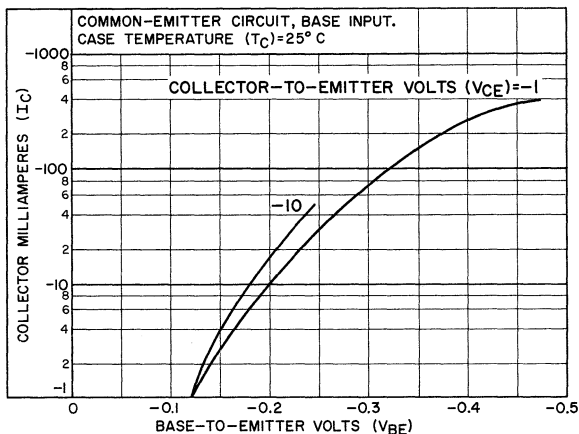
Music power output** = 2.5 watts

* Obtained from regulated power supply designed to deliver constant voltage over the indicated range of collector current.

** EIA Standard #RS-234-A, Section 2.1.2.1.

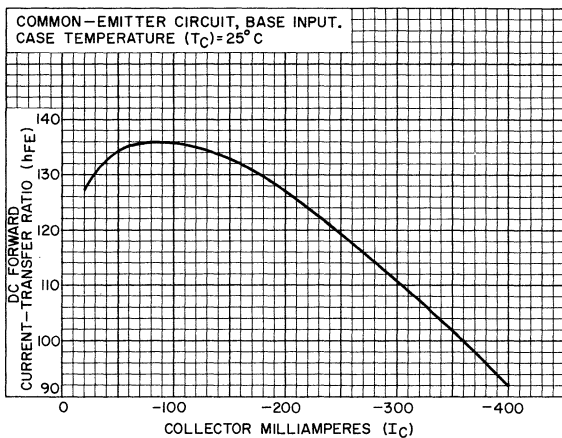


Typical Transfer Characteristic



92CS-12590

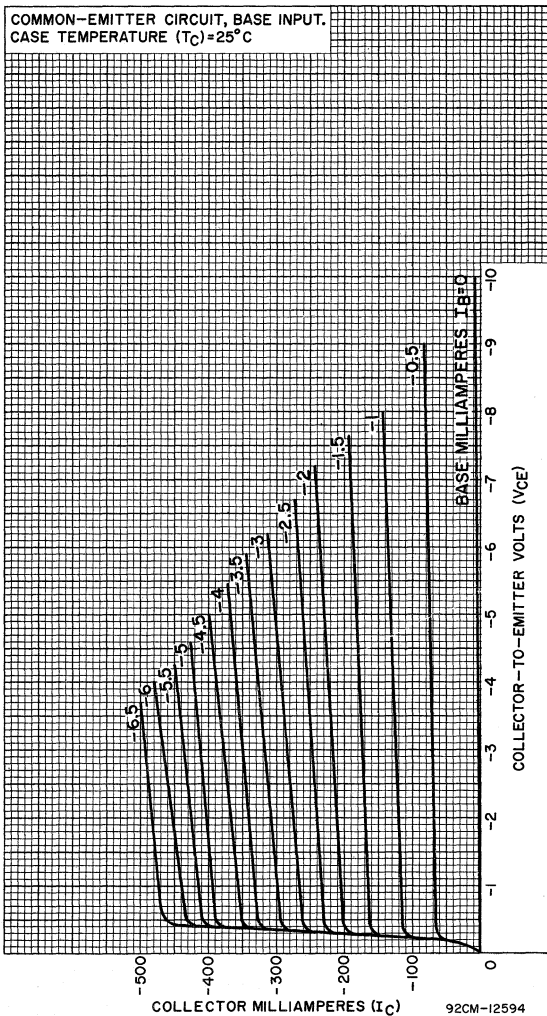
Typical DC Beta Characteristic



92CS-12592



Typical Collector Characteristics



Power Transistor

GERMANIUM P-N-P ALLOY TYPE

For Class A Audio-Frequency Power-Amplifier
Service in Driver and Output-Stage Applications

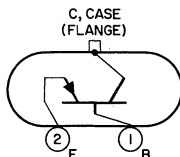
Mechanical:

Dimensions. See Outline TO-3 in General Section
Pin Length. 0.440" - 0.480"
Maximum Mounting-flange Thickness. 0.050"

Terminal Diagram

BOTTOM VIEW

Pin 1 - Base
Pin 2 - Emitter



Mounting Flange-
Collector,
Case

Maximum Ratings, Absolute-Maximum Values:

Collector-to-Base Voltage.	V_{CBO}	-32 max.	volts
With emitter open			
Collector-to-Emitter Voltage	V_{CER}	-32 max.	volts
With external base-to-emitter resistance (ohms) ≤ 33			
Emitter-to-Base Voltage.	V_{EBO}	-5 max.	volts
With collector open			
Collector Current.	I_C	-5 max.	amp
Base Current	I_B	-1 max.	amp

Transistor Dissipation:

At mounting-flange
temperatures:^a

From -65° to 81° C	P_T	12.5 max.	watts
Above 81° C.	Derate linearly 0.66 watt/°C		

Temperature:

Operating range (Junction)	T_{opr}	-65 to 100	°C
Storage range.	T_{stg}	-65 to 100	°C
Pin-Soldering Temperature.	T_p	225	°C
(For 10 seconds max.) ^b			

ELECTRICAL CHARACTERISTICS

Unless otherwise specified, electrode-voltage and
electrode-current values for given test conditions
are dc; mounting flange temperature = 25° C

Min. Typ. Max.

Collector-to-Base Breakdown Voltage.	BV_{CBO}	-32	-	-	volts
$I_C = -0.005$ amp., $I_E = 0$					



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		Min.	Typ.	Max.	
Collector-to-Emitter					
Breakdown Voltage. . .	BV_{CER}	-32	-	-	volts
$I_C = -0.2$ amp., $R_{BE} = 33$ ohms					
Emitter-to-Base					
Breakdown Voltage. . .	BV_{EBO}	-5	-	-	volts
$I_E = -0.002$ amp., $I_C = 0$					
Collector-Cutoff					
Current.	I_{CBO}	-	-	-3	ma
$V_{CB} = -30$ volts, $I_E = 0$					
Collector-Cutoff					
Saturation Current. . .	$I_{CBO}(sat)$	-	-	-0.16	ma
$V_{CB} = -0.5$ volts, $I_E = 0$					
DC Forward-Current					
Transfer Ratio . . .	h_{FE}	30	70	-	
$V_{CE} = -2$ volts, $I_C = -1$ amp.					
Gain-Bandwidth Product					
	f_T	-	300	-	kc
$V_{CE} = -5$ volts, $I_C = -0.5$ amp.					
Thermal Resistance . .					
Junction-to-case	θ_{JC}	-	-	1.5	$^{\circ}C/watt$

Typical Operation:

*In class A AF-amplifier circuit at
mounting-flange temperature of 25 $^{\circ}$ C*

DC Collector Supply Voltage (V_{CC})	-16	volts
DC Collector-to-Emitter Voltage	-13.2	volts
DC Collector Current.	-0.9	amp
Peak Collector Current.	-1.8	amp
Input Impedance	15	ohms
Collector Load Impedance.	15	ohms
Maximum Collector Dissipation	12	watts
Power Gain.	36	db
Total Harmonic Distortion at 5 watts Output . .	5	%
Maximum-Signal Power Output	5	watts

^a Measured at center of seating plane.

^b Measured along pin at distances equal to or greater than 1/32" from seating plane.

**OPERATING CONSIDERATIONS,
SUGGESTED MOUNTING ARRANGEMENT,
& ALL CHARACTERISTICS CURVES**
shown under type 40022 also apply to type 40254

Transistors

SILICON N-P-N TRIPLE-DIFFUSED TYPES

For High-Speed Switching and Linear-Amplifier Applications Such as High-Voltage Differential and Operational Amplifiers, High-Voltage Inverters, and High-Voltage, Low-Current Switching and Series Regulators, in Military, Industrial, and Commercial Equipment.

Except for the items shown below, the 40255 is the same as the 2N3439 and the 40256 is the same as the 2N3440

Mechanical:

Dimensions. See accompanying Dimensional Outline

Maximum Ratings, Absolute-Maximum Values:

Transistor Dissipation

At case temperatures:

From -65° to 50° C. . . . P_T 10 max. watts

Above 50° to 200° C. . . . Derate linearly 0.066 watt/ $^{\circ}$ C

At free-air temperatures: Not applicable to these types

ELECTRICAL CHARACTERISTICS

Thermal Resistance. θ_{JC} 15 max. $^{\circ}$ C/watt

Junction-to-case,

$P_O = 2$ to 4 watts, $I_E = 100$



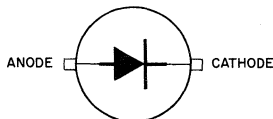
Silicon Rectifier

HIGH-RELIABILITY STUD-MOUNTED DIFFUSED-JUNCTION TYPE

For Aerospace and Military Applications

MECHANICAL

Operating Position. Any
 Dimensions. See Outline DO-4 in General Section
 Case Seals. Hermetic
 Terminal Diagram



The arrow indicates direction of forward current flow as indicated by dc ammeter

HALF-WAVE RECTIFIER

Maximum Ratings, Absolute-Maximum Values

For single-phase operation and with resistive or inductive load

Peak Reverse Voltage.	600	V
Transient Reverse Voltage	800	V
(Non-repetitive 5-msec max. duration and case temperature range of 0 to 200° C)		
RMS Supply Voltage.	424	V
DC Blocking Voltage	600	V
Average Forward Current		
At 150° C case temperature.	12	A
At other case temperatures.	See Rating Chart	
Peak Recurrent Current.	50	A
Peak Surge Current ^a		
One-half cycle, sine wave, 60 c/s	250	A
For one or more than one cycle.	See Peak-Surge-Current Rating Chart	
Case Temperature Range.	-65 to +200	°C
Operating and storage		

Characteristics

Maximum Forward Voltage Drop ^b	0.55	V
Maximum Reverse Current		
Dynamic at 60 c/s ^b	0.6	mA
Static ^c	0.002	mA
Maximum Thermal Resistance, Junction to Case. . .	2	°C/W

^a Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal-equilibrium conditions.

^b Average value for one complete cycle at case temperature of 150° C and at maximum rated voltage and average forward current.

^c DC value, at maximum peak reverse voltage, and case temperature (°C) = 25.



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STRESS-SCREENING PROCEDURES

40259's which Meet the Preceding Tight Limits are then Subjected to the Following Stress-Screening Procedures.

1. **Temperature Cycling** — per Method 102A of MIL-STD-202B: 10 cycles; temperature range, -65°C to $+200^{\circ}\text{C}$.
2. **High-Temperature Storage** — continuous storage at a minimum temperature of 200°C for a minimum of 96 hours.
3. **Constant Acceleration** — per Method 2006 of MIL-STD-750: 10,000 g's; acceleration for 3 minutes in each of three orthogonal axes (X_1 , Y_1 , Z_1).
4. **Operational Vibration** — at a frequency of 57 ± 2 cycles per second with a minimum displacement of 0.1 inch for 30 seconds. Rated voltage, at 60 c/s, is applied during the test and the trace is monitored on an oscilloscope. Observed discontinuities, flutter, drift, or shift constitute rejection items.
5. **Helium Bomb Test** — 50 psig, 4 hours. Post test criterion, 1×10^{-8} cc atoms/sec.
6. **Methanol Bomb Test** — 70 psig, 18 hours.
7. **High-Temperature Burn-In** — under the following conditions: $V_R = 600$ V peak; $I_F = 0.5$ A; case temperature (T_C) = 175°C ; duration = 250 hours.
8. **X-Ray Inspection** — in X_1 and Z_1 axes.
9. **Visual Reinspection** — complete visual reinspection with high-power optical system.

Following Stress Screening, each 40259 is Recriticized for Electrical Performance According to the Following Table; and the Readings Obtained are Recorded.

Characteristic	Symbol	Test Conditions	Maximum Limits	Max Drift Screen Criteria (delta-shift)	Units
Average Forward Voltage (Full Cycle)	V_{F1}	$I_F = 12$ A, $T_C = 150^{\circ}\text{C}$	0.55	0.1	V
Average Reverse Current (Full Cycle)	I_{R1}	$I_F = 12$ A, $T_C = 150^{\circ}\text{C}$ V_R (peak) = 600 V	0.6	0.2	mA
Peak Forward Voltage	V_{F2}	i_F (peak) = 12 A, $T_C = 25^{\circ}\text{C}$	1.1	0.1	V
Static Reverse Current	I_{R2}	$V_R = 600$ V DC, $T_C = 25^{\circ}\text{C}$	0.002	0.001	mA

Each unit is packaged individually, and recorded electrical data as well as x-radiation film records are included with each shipment.



SPECIAL MANUFACTURING PROCEDURES

Each 40259 is Subjected to the Five Special Manufacturing Steps Specified Below.

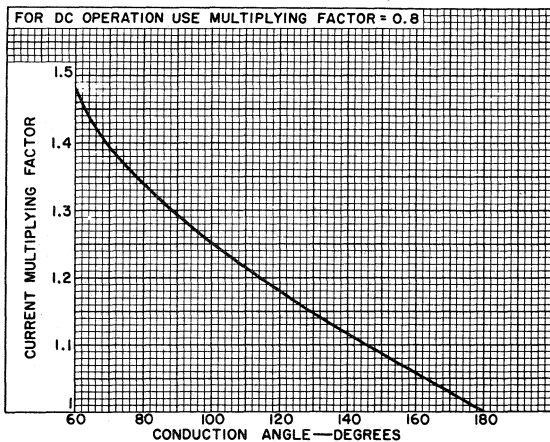
1. **Visual Mount Test** — critical visual inspection with high-power optical system to assure part alignment, proper soldering, and to reveal mechanical defects.
2. **Helium Bomb Test** — to assure hermetic sealing.
3. **Stabilization Bake** — for 96 hours to assure electrical and mechanical stability.
4. **Controlled Gold-Plating** — 30 to 40 microinches to provide improved resistance to adverse environments and to facilitate the making of proper electrical connections to rectifier terminals.
5. **Preliminary Electrical Tests** — measurement of average forward voltage, peak forward voltage, static reverse current, and dynamic reverse current.

Each 40259 is Assigned an Individual Serial Number and then Tested at Maximum Ratings for the Following Electrical Characteristics. The Measured Values are Recorded.

Characteristic	Symbol	Test Conditions	Maximum Limits	Units
Average Forward Voltage (Full Cycle)	V_{F1}	$I_F = 12 \text{ A},$ $T_C = 150^\circ \text{ C}$	0.55	V
Average Reverse Current (Full Cycle)	I_{R1}	$I_F = 12 \text{ A},$ $T_C = 150^\circ \text{ C},$ $V_R (\text{peak}) = 600 \text{ V}$	0.6	mA
Peak Forward Voltage	V_{F2}	$i_F (\text{peak}) = 12 \text{ A},$ $T_C = 25^\circ \text{ C}$	1.1	V
Static Reverse Current	I_{R2}	$V_R = 600 \text{ V DC},$ $T_C = 25^\circ \text{ C}$	0.002	mA



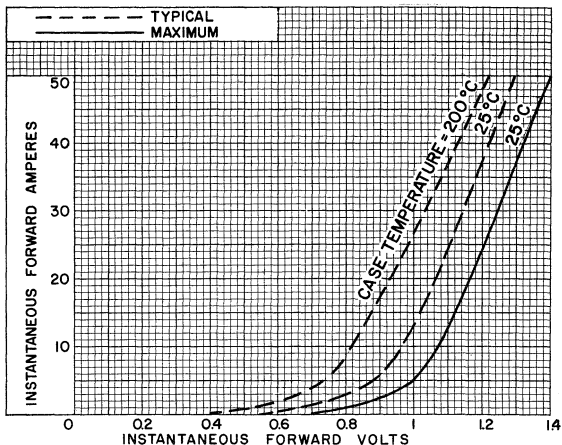
Current-Multiplying-Factor Chart for Polyphase and DC Operation



92CS-10910

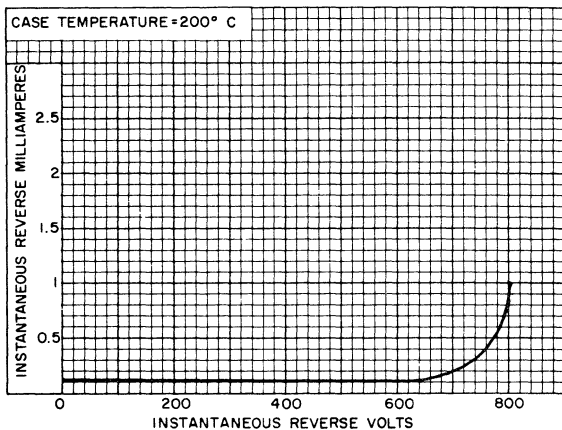


Forward Characteristics



92CS-13135

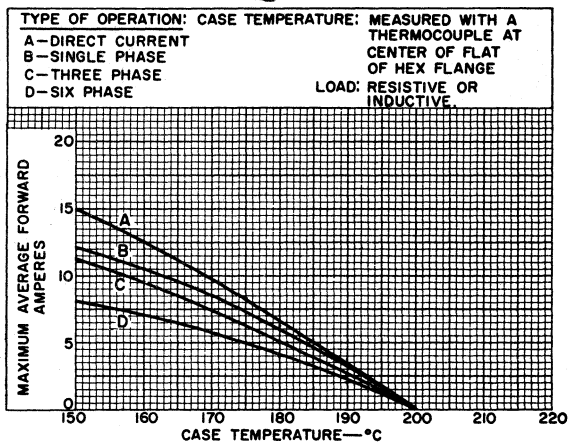
Typical Reverse Characteristics



92CS-13112

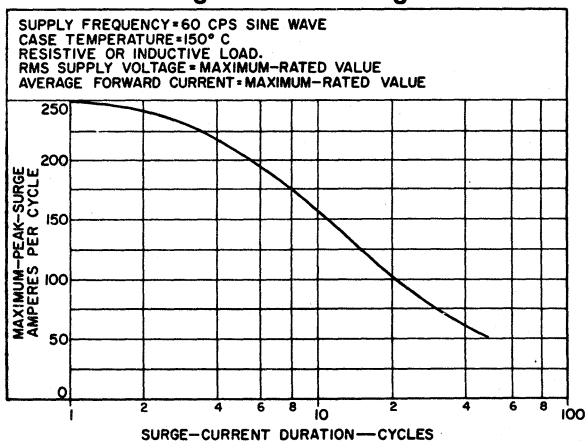


Rating Chart



92CS-13111

Peak-Surge-Current Rating Chart



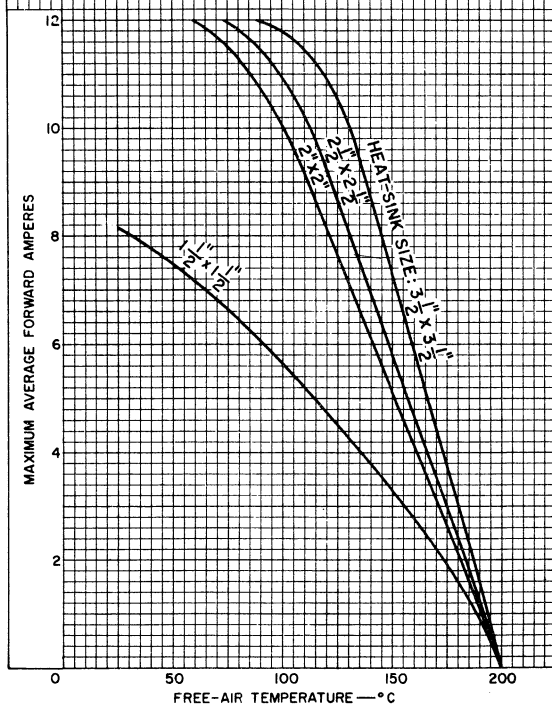
92CS-13113



Operation Guidance Chart

NATURAL COOLING

NATURAL COOLING.
SINGLE-PHASE OPERATION.
RECTIFIER TYPE IS STUD-MOUNTED DIRECTLY
ON HEAT SINK.
HEAT SINK: 1/16" THICK COPPER WITH A MAT
BLACK SURFACE AND THERMAL EMISSIVITY
OF 0.9.



92CM-11068RI



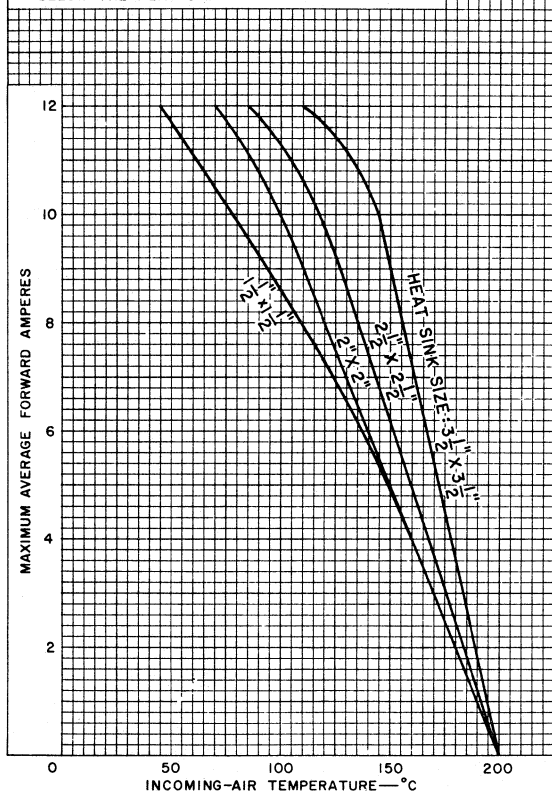
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Harrison, N. J.

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Operation Guidance Chart

FORCED-AIR COOLING

FORCED-AIR COOLING: AIR VELOCITY=1000 FEET PER MINUTE PARALLEL TO PLANE OF HEAT SINK.
SINGLE-PHASE OPERATION.
RECTIFIER TYPE IS STUD-MOUNTED DIRECTLY ON HEAT SINK.
HEAT SINK: 1/16"-THICK COPPER WITH A MAT BLACK SURFACE AND THERMAL EMISSIVITY OF 0.9.
INCOMING-AIR TEMPERATURE: MEASURED AT A POINT IN SPACE 1/4" AWAY FROM THE CASE AND 1/4" BELOW THE HEAT SINK.



92CM-11067RI



40261 to 40265

Transistor-Rectifier Complement

For *Line-Operated* AM Broadcast-Band Radio Receivers
and Phonographs

40261, 40262 - GERMANIUM P-N-P DRIFT-FIELD TRANSISTORS
For Converter and IF-Amplifier Stages Respectively

40263 - GERMANIUM P-N-P JUNCTION TRANSISTOR
For Low-Level AF-Amplifier and Driver Stages

40264 - SILICON N-P-N HIGH-VOLTAGE POWER TRANSISTOR
For Class A Output-Amplifier Stages

40265 - DIFFUSED JUNCTION SILICON RECTIFIER (SINGLE-ENDED)
For Complement Power Supplies

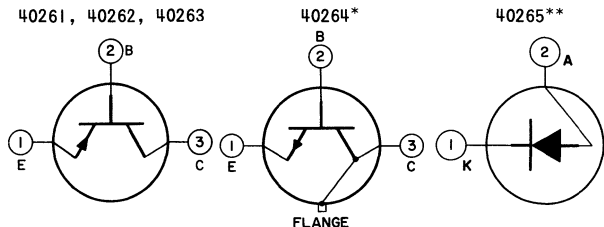
Mechanical:

Dimensions:

40261, 40262, 40263. . . See *Outline TO-1* in General Section

40264, 40265 See accompanying Dimensional Outlines

Terminal Diagrams:



Lead 1 - Emitter
Lead 2 - Base
Lead 3 - Collector

Lead 1 - Emitter
Lead 2 - Base
Lead 3 - Collector

Lead 1 - Cathode
color dot adjacent
to cathode lead
Lead 2 - Anode

*Collector is Connected to the Mounting Flange.

**The arrow indicates direction of forward current as indicated by dc ammeter,
which is in the direction toward the lead adjacent to the polarity mark.

Maximum Ratings, Absolute-Maximum Values:

	TRANSISTORS			
	40261 40262	40263	40264	
Collector-to-Base Voltage				
With emitter open. . . V_{CBO}	-50	-20	300	max. volts
$V_{EB} = -0.5$ volt, $I_C = -50 \mu a$ V_{CBV}	-34	-	-	max. volts
Collector-to-Emitter Voltage				
$R_{BE} = 10000$ ohms . . . V_{CER}	-	-16	-	max. volts
$I_C = 1$ ma, $I_B = 5 \mu a$. . . V_{CEX}	-	-	300	max. volts



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40261 to 40265

		40261 40262	40263	40264	
Emitter-to-Base Voltage.	V_{EB}	-0.5	-2.5	3	max. volts
Collector Current. . .	I_C	-10	-50	100	max. ma
Emitter Current. . . .	I_E	10	50	-100	max. ma

Transistor Dissipation

At free-air temperatures:

40261, 40262

From -65° to

25° C. P_T 80 max. mw

Above 25° to

71° C. Derate linearly $0.978 \text{ mw}/^{\circ}\text{C}$

Above 71° C. Derate linearly $2.5 \text{ mw}/^{\circ}\text{C}$

40263

From -65° to

55° C. P_T 120 max. mw

Above 55° C. Derate linearly $2.666 \text{ mw}/^{\circ}\text{C}$

At mounting-flange temperatures:^a

40264

From -65 to

70° C. P_T 4 max. watts

Above 70° C. Derate linearly $0.050 \text{ watts}/^{\circ}\text{C}$

RECTIFIER

		40265	
Peak Reverse Voltage.	PRV	400 max.	volts
RMS Supply Voltage.	V_{RMS}	140 max.	volts

Forward Current

At free-air temperatures:

From -65° to 65° C

DC. I_F 125 max. ma

Peak Repetitive. i_{PR} 1.3 max. amp

Above 65° C. Derate linearly $0.909 \text{ amp}/^{\circ}\text{C}$

Surge Current

For "turn-on" time of 2 milliseconds at free-air

temperature of 25° C. i_S 30 max. amp

At free-air temperature

above 65° C. Derate linearly $0.909 \text{ amp}/^{\circ}\text{C}$

TRANSISTORS AND RECTIFIER

		40261 40262	40263	40264	40265	
Temperature Range						
Operating.	T_{opr}	-65 to 85	-65 to 100	-65 to 150	-65 to 175	$^{\circ}\text{C}$
Storage.	T_{stg}	-65 to 85	-65 to 100	-65 to 150	-65 to 175	$^{\circ}\text{C}$



40261 to 40265

	40261 40262	40263	40264	40265	
Lead Soldering Temperature ^b T_L (For 10 sec. max.)	255	255	255	255	°C

ELECTRICAL CHARACTERISTICS

Unless otherwise specified, electrode-voltage and electrode-current values for given test conditions are dc at free-air temperature = 25° C (Types 40261, 40262, 40263, 40265); mounting-flange temperature = 25° C (Type 40264).

TRANSISTORS

	40261	40262	40263	40264	
Collector-to-Base Break-down Voltage $I_C = -0.05$ ma, $I_E = 0$ BV_{CBO}	-50	-50	-	-	min. volts
$I_C = 0.1$ ma, $I_E = 0$ BV_{CBO}	-	-	-	300	min. volts
$V_{EB} = -0.5$ ma, $I_C = -0.05$ ma. BV_{CBV}	-34	-34	-	-	min. volts
Collector-to-Emitter Break-down Voltage $R_{BE} = 10000$ ohms, $I_C = -1$ ma . . . BV_{CER}	-	-	-18	-	min. volts
$I_C = 1$ ma, $I_B = 0.005$ ma. BV_{CEX}	-	-	-	300	min. volts
Emitter-to-Base Breakdown Voltage $I_E = -0.012$ ma, $I_C = 0$ BV_{EBO}	-0.5	-0.5	-	-	min. volt
$I_E = -0.05$ ma, $I_C = 0$ BV_{EBO}	-	-	-2.5	-	min. volts
$I_E = 0.1$ ma, $I_C = 0$ BV_{EBO}	-	-	-	3	min. volts
Collector-Cutoff Current $V_{CB} = -12$ volts, $I_E = 0$ I_{CBO}	-12	-12	-	-	max. μ a
$V_{CB} = -20$ volts, $I_E = 0$ I_{CBO}	-	-	-12	-	max. μ a
$V_{CB} = 300$ volts, $I_E = 0$ I_{CBO}	-	-	-	100	max. μ a
Collector-Cutoff Current I_{CEX} $V_{CE} = 300$ volts, $I_B = 0.005$ ma	-	-	-	1	max. ma



40261 to 40265

	40261	40262	40263	40264		
Emitter-Cutoff						
Current						
$V_{EB} = 0.5$ volts,						
$I_C = 0. \dots I_{EBO}$	-12	-12	-	-	max.	μa
$V_{EB} = 2.5$ volts,						
$I_C = 0. \dots I_{EBO}$	-	-	-12	-	max.	μa
Static Forward						
Current-Transfer						
Ratio.	h_{FE}	-	-	30	min.	
$V_{CE} = 10$ volts,	h_{FE}	-	-	60	typ.	
$I_C = 50$ ma	h_{FE}	-	-	150	max.	
Gain-Bandwidth						
Product						
$V_{CE} = -12$ volts,						
$I_C = -1$ ma. . .	f_T	40	30	-	typ.	Mc
$V_{CE} = 50$ volts,						
$I_C = 20$ ma. . .	f_T	-	-	25	typ.	Mc
Small-Signal						
Forward Current-Transfer						
Ratio.	h_{fe}	27	82	100	-	min.
$f = 1$ kc,	h_{fe}	80	150	160	-	typ.
$V_{CE} = -6$ volts,	h_{fe}	170	350	325	-	max.
$I_C = -1$ ma						
Small-Signal						
Forward Current-Transfer Ratio Cutoff						
Frequency. . .	f_{hfb}	-	-	10	-	typ. Mc
$V_{CE} = -6$ volts,						
$I_C = -1$ ma						
Base-Spreading						
Resistance						
$f = 100$ Mc						
$V_{CE} = -12$ volts,						
$I_C = -1$ ma. . .	$r_{bb'}$	25	25	-	-	typ. ohms
$V_{CE} = -6$ volts,						
$I_C = -1$ ma. . .	$r_{bb'}$	-	-	200	-	typ. ohms
$V_{CE} = 50$ volts,						
$I_C = 20$ ma. . .	$r_{bb'}$	-	-	-	20	typ. ohms
Output						
Capacitance						
$V_{CB} = -12$ volts,						
$I_E = 0. \dots C_{ob}$		3.7	3.4	-	-	max. pf
$V_{CB} = 50$ volts,						
$I_E = 0. \dots C_{ob}$		-	-	5	-	typ. pf
Thermal						
Resistance . . .	θ_{JMF}	-	-	-	20	max. $^{\circ}C/watt$
Junction-to-Mounting Flange						



40261 to 40265

RECTIFIER

40265

Instantaneous Forward Voltage Drop. . . v_F	1	max.	volt
$I_F = 125$ ma			
Reverse Current			
Dynamic i_R	-0.4	max.	ma
$T_{FA} = 65^\circ \text{C}$, PRV = 400 volts,			
$I_F = 125$ ma			
Static. I_R	-6	max.	μa
PRV = 400 volts, $I_F = 0$			

Typical Performance Data for an AM Broadcast-Band Radio Receiver at Line Voltage = 117 volts, 60 cps

	Signal Frequency, Kc			
	600	1000	1400	
Sensitivity at 50-mw output.	80	85	100	$\mu\text{v/m}$
Noise at indicated Sensitivity:				
80 $\mu\text{v/m}$	-11	-	-	db
85 $\mu\text{v/m}$	-	-12	-	db
100 $\mu\text{v/m}$	-	-	-15	db
AGC Figure of Merit				
For Input Signal				
Strength = 50000 $\mu\text{v/m}$	35	35	35	db
Adjacent-Channel Attenuation	20	19	17	db
Bandwidth:				
6 db down.	7.3	8.2	8.7	kc
20 db down.	19.2	23	25.7	kc
Image Rejection.	55	48	34.5	db
IF Rejection	34	43	60	db
RF Overload Level for 10% Total				
Harmonic Distortion:				
30% modulation	-	2.5	-	v/m
80% modulation	-	0.22	-	v/m
Total Harmonic Distortion				
At 200-mw output, for 10,000 $\mu\text{v/m}$				
input signal modulation 30%				
at 1 kc.	-	3	-	%

Typical Operation of RCA-40261 at 1.5 Mc in a Self-Excited Converter Circuit, at $T_{FA} = 25^\circ \text{C}$

Common-Emitter Circuit, Base Input

DC Collector-Supply Voltage, V_{CC}	18	volt
DC Collector-to-Emitter Voltage, V_{CE}	-17	volt
DC Emitter Current, I_E	1.5	ma
Input Resistance, R_{IN}	1500	ohms
Output Resistance, R_{OUT}	0.35	megohm
Base-to-Emitter Oscillation Injection Voltage.	100	mv



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40261 to 40265

Conversion Power Gain, G_c :	40264	
Maximum Available Gain,	53	db
Useful Gain	43	db

Typical Operation of RCA-40262 in a Single-Stage 455-kc Amplifier Circuit, at $T_{FA} = 25^\circ C$

Common-Emitter Circuit, Base Input

DC Collector-Supply Voltage, V_{CC}	18	volts
DC Collector-to-Emitter Voltage, V_{CE}	-17	volts
DC Emitter Current, I_E	2	ma
Input Resistance, R_{IN}	1550	ohms
Output Resistance, R_{OUT}	0.25	megohm
Collector-to-Base Capacitance, C_{cb}	2.9	pf
Power Gain		
Maximum Available Gain ^c	56	db
Useful Gain:		
Circuit neutralized	40	db
Circuit not neutralized	35	db

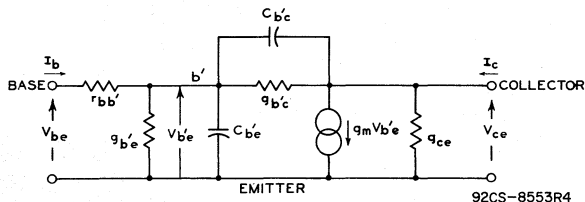
a Measured at center of seating surface.

b Measured along lead at distances not less than 1/32" from seating plane.

c Measured in a single-tuned unilateralized circuit matched to the generator and load impedances for maximum transfer of power (transformer insertion losses not included).

HYBRID π EQUIVALENT CIRCUIT

With Corresponding Small-Signal Parameters for 40263



$V_{ce} =$	-6	volts	$g_{ce} =$	6	μ hos
$I_c =$	-1	ma	$C_{b'e} =$	750	pf
$r_{bb'} =$	300	ohms	$C_{b'c} =$	9	pf
$g_{b'e} =$	250	μ hos	$g_m =$	38500	μ hos
$g_{b'c} =$	0.35	μ ho			

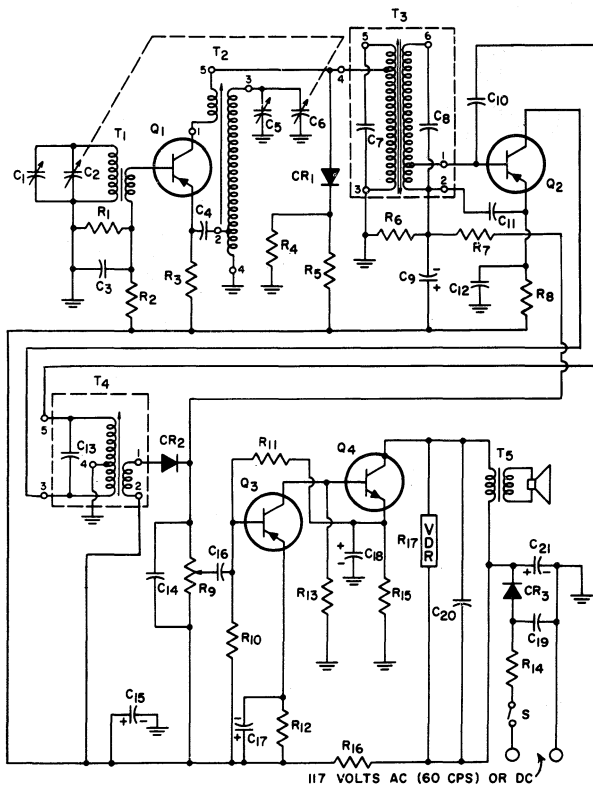
NOTE: The approximate frequency f for unity power amplification based on this equivalent circuit is given by:

$$f = \frac{1}{4\pi} \sqrt{\frac{g_m}{r_{bb'} C_{b'e} C_{b'c}}}$$



40261 to 40265

LINE-OPERATED, AM BROADCAST-BAND RECEIVER CIRCUIT using 40261, 40262, 40263, 40264, and 40265



92CM-12711

C_1, C_5 = Trimmers for tuning-capacitor gang
 C_2, C_6 = Ganged tuning capacitors
 C_3, C_4 = $0.02 \mu f$
 C_7, C_8 = 100 pf (part of T_3)
 C_9 = $5 \mu f$, 3v, electrolytic
 C_{10} = 1 pf
 C_{11}, C_{20} = $0.01 \mu f$

C_{12}, C_{14} = $0.05 \mu f$
 C_{13} = 170 pf (part of T_4)
 C_{15} = $100 \mu f$, 25 v, electrolytic
 C_{16} = $1 \mu f$
 C_{17} = $50 \mu f$, 15 v, electrolytic
 C_{18} = $250 \mu f$, 12 v, electrolytic
 C_{19} = $0.047 \mu f$, 400 v



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DATA 4

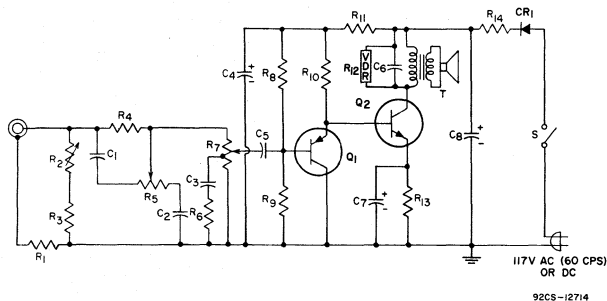
10-64

40261 to 40265

$C_{21} = 80 \mu f$, 150 v, electrolytic
 $CR_1, CR_2 =$ Germanium diode, Type 1N295
 $CR_3 =$ Silicon rectifier, RCA-40265
 $Q_1 =$ RCA-40261
 $Q_2 =$ RCA-40262
 $Q_3 =$ RCA-40263
 $Q_4 =$ RCA-40264
 $R_1, R_5 = 47000$ ohms, 0.5 watt
 $R_2, R_{13} = 2200$ ohms, 0.5 watt
 $R_3 = 470$ ohms, 0.5 watt
 $R_4 = 4700$ ohms, 0.5 watt
 $R_6 = 220000$ ohms, 0.5 watt
 $R_7 = 10000$ ohms, 0.5 watt
 $R_8 = 270$ ohms, 0.5 watt
 $R_9 =$ Volume control, potentiometer,
 10000 ohms, 0.5 watt, audio taper

$R_{10} = 56000$ ohms, 0.5 watt
 $R_{11} = 18000$ ohms, 0.5 watt
 $R_{12} = 820$ ohms, 0.5 watt
 $R_{14} = 250$ ohms, 4 watts
 $R_{15} = 330$ ohms, 0.5 watt
 $R_{16} = 6200$ ohms, 0.5 watt
 $R_{17} =$ Voltage-dependent resistor,
 Ferroxcube No.E299DD-P340
 or equivalent
 $S =$ On-Off switch, part of R_9
 $T_1 =$ Antenna transformer
 $T_2 =$ Oscillator transformer
 $T_3 =$ 1st if transformer
 $T_4 =$ 2nd if transformer
 $T_5 =$ Output transformer: primary
 impedance, 2500 ohms;
 secondary impedance, 3.2
 ohms; efficiency, 80 per
 cent; Triad Type S-12X or
 equivalent

LINE-OPERATED 1-WATT PHONOGRAPH AMPLIFIER CIRCUIT using 40263, 40264, 40265



$C_1, C_2 = 1200$ pf
 $C_3 = 0.005 \mu f$
 $C_4 = 100 \mu f$, 25 v, electrolytic
 $C_5 = 0.1 \mu f$
 $C_6 = 0.01 \mu f$
 $C_7 = 250 \mu f$, 12 v, electrolytic
 $C_8 = 50 \mu f$, 150 v, electrolytic
 $CR_1 =$ Silicon rectifier, RCA-40265
 $Q_1 =$ RCA-40263
 $Q_2 =$ RCA-40264
 $R_1 = 56000$ ohms, 0.5 w
 $R_2 =$ bass control; potentiometer,
 3 megohms, audio taper
 $R_3, R_9 = 68000$ ohms, 0.5 w
 $R_4 = 0.33$ megohm, 0.5 w

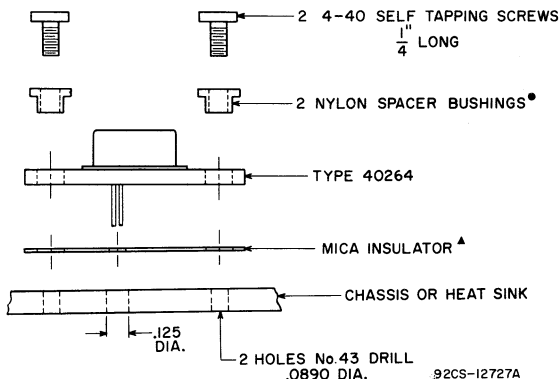
$R_5 =$ treble control; potentiometer,
 1 megohm, audio taper
 $R_6, R_{10} = 10000$ ohms, 0.5 w
 $R_7 =$ loudness control; potentiometer,
 2 megohms, linear taper; tapped
 at 1 megohm
 $R_8 = 0.18$ megohm, 0.5 w
 $R_{11} = 33000$ ohms, 0.5 w
 $R_{12} =$ Voltage-dependent resistor
 Ferroxcube No.E299DD-P340
 or equivalent
 $R_{13} = 220$ ohms, 0.5 w
 $R_{14} = 250$ ohms, 3 w
 $S =$ On-Off switch
 $T =$ output transformer, primary
 impedance, 2500 ohms,
 secondary impedance 3.2
 ohms, efficiency 80 per cent;
 Triad S-12X or equivalent



40261 to 40265

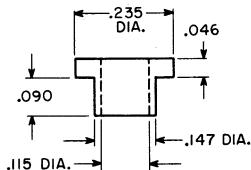
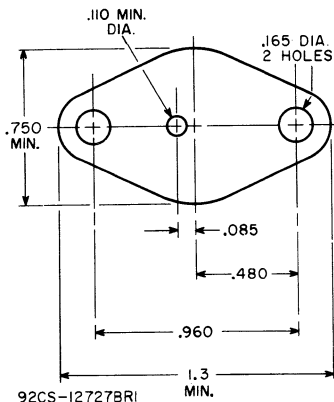
SUGGESTED MOUNTING ARRANGEMENT

40264



Mica Insulator

Nylon Spacer Bushing



DIMENSIONS IN INCHES

• Except for .090" dimension, this spacer bushing is identical to H.H. Smith Co., 2326 Nostrand Ave., Brooklyn 10, N.Y., Part No.2534 or equivalent.

▲ Information on mica insulators having these dimensions may be obtained from fabricators of insulating components such as: Reliance Mica Co. 341-351 39th St., Brooklyn 32, N.Y., (Part No.RM936)-United Mineral and Chemical Corporation, 16 Hudson St., N.Y. 14, N.Y., or any other supplier of similar components.

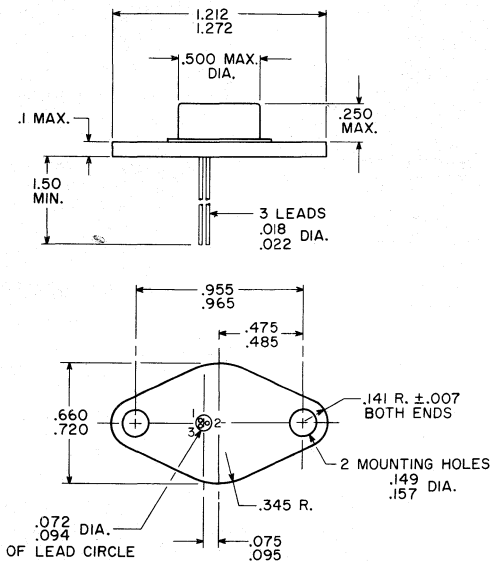


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DATA 5
10-64

40261 to 40265

DIMENSIONAL OUTLINE 40264

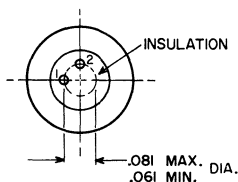
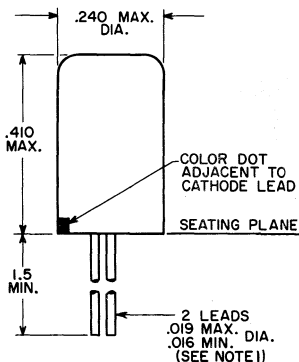


92CS-12728

DIMENSIONS IN INCHES

40261 to 40265

DIMENSIONAL OUTLINE 40265

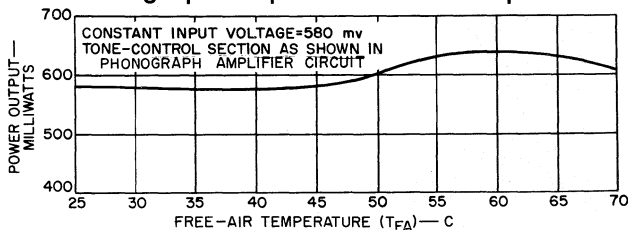


92CS-11676R1

DIMENSIONS IN INCHES

NOTE 1: The specified lead diameter applies in the zone between 0.050" and 0.250" from the base seat. Between 0.250" and 1.50" a maximum of 0.21" diameter is held.

Relative Sensitivity at Typical Listening Levels of Phonograph Amplifier Free-Air Temperature



92CS-12725

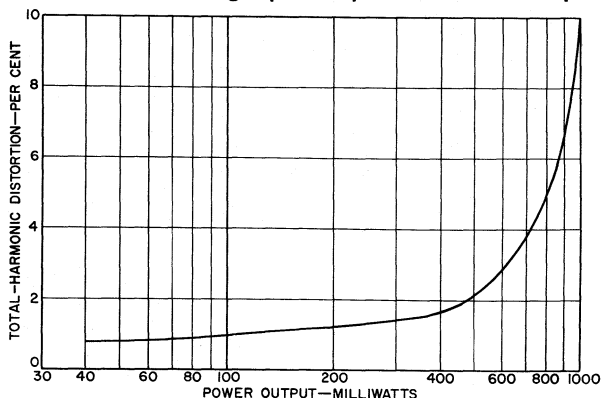


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DATA 6
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40261 to 40265

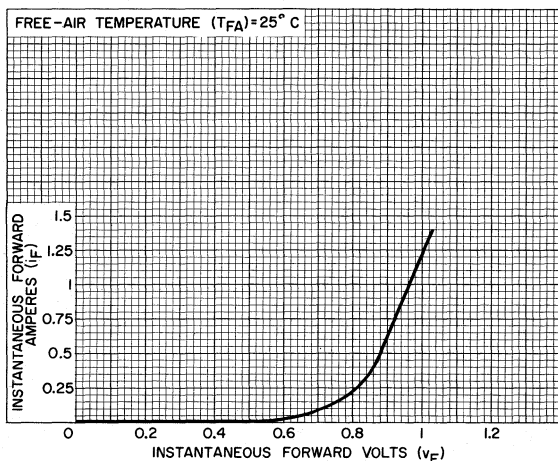
Distortion of Phonograph Amplifier Power Output



92CS-12726RI

Typical Forward Characteristic

40265



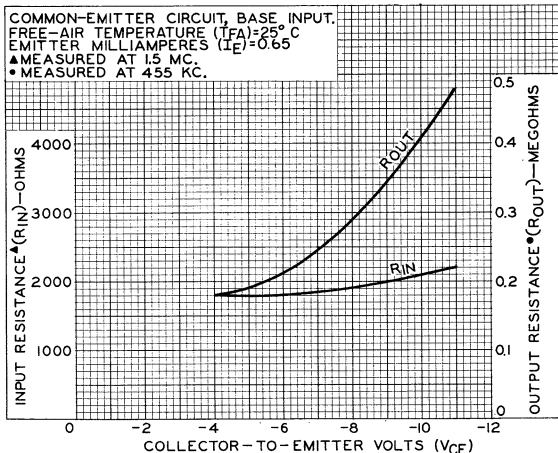
92CS-11669



40261 to 40265

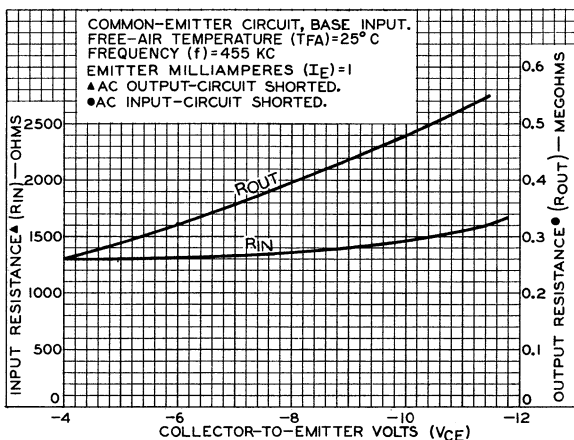
Performance Characteristics

40261



92CS-10583R2

40262



92CS-10419R2



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 Electronic Components and Devices

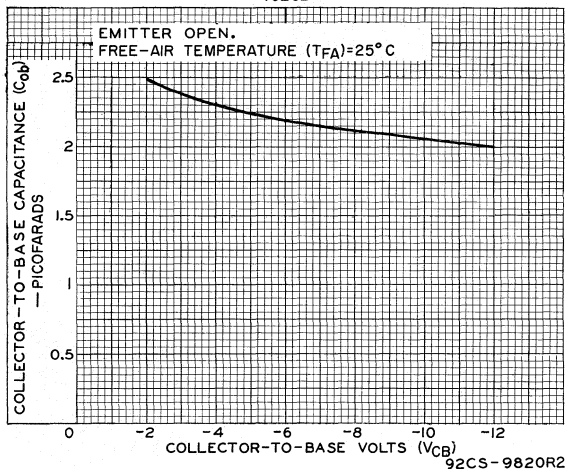
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DATA 7
 10-64

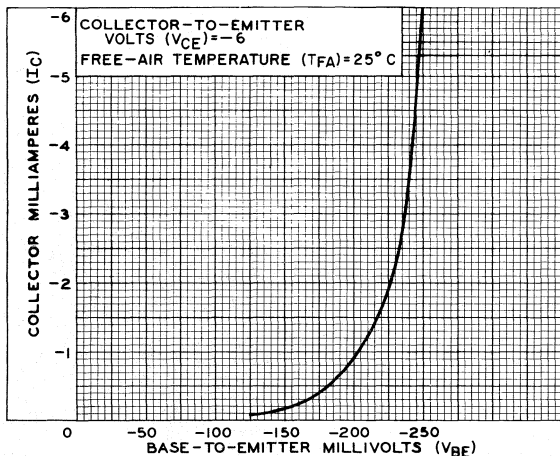
40261 to 40265

Typical Characteristic

40262



40261, 40262

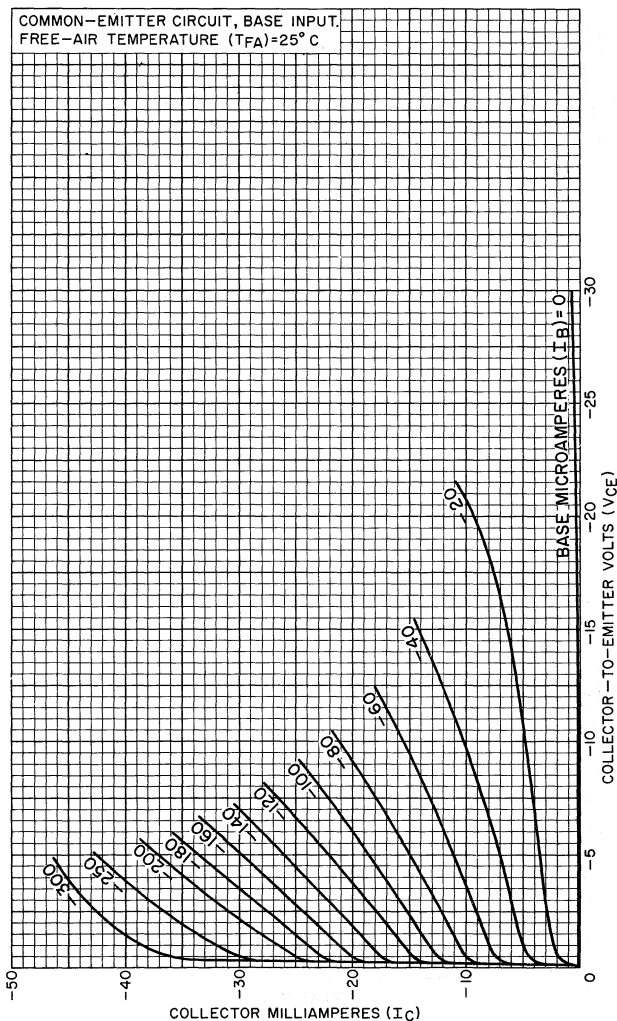


40261 to 40265

Typical Collector Characteristics

40263

COMMON-EMITTER CIRCUIT, BASE INPUT.
FREE-AIR TEMPERATURE (T_{FA}) = 25° C



92CM-11836R2



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Electronic Components and Devices

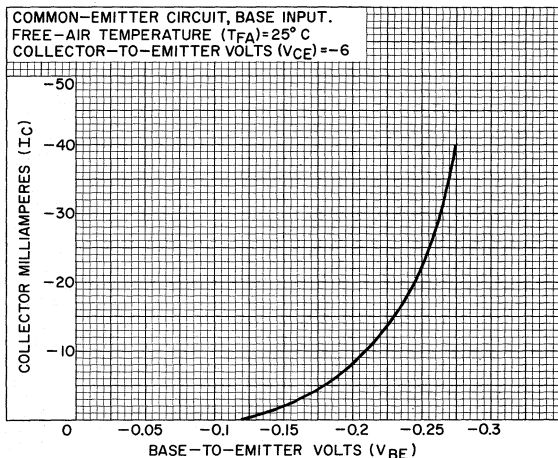
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DATA 8
10-64

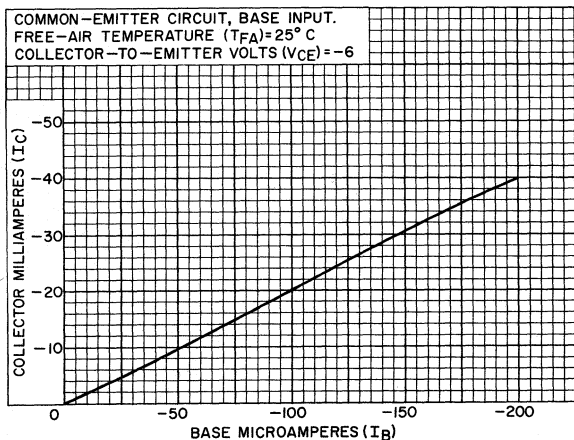
40261 to 40265

Typical Transfer Characteristic

40263



92CS-11843R2

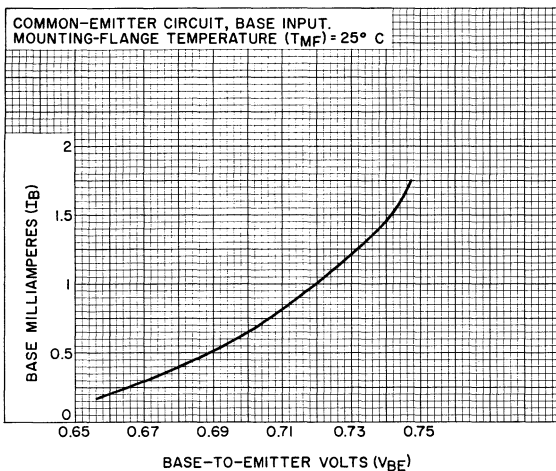


92CS-11851R2



Typical Input Characteristic

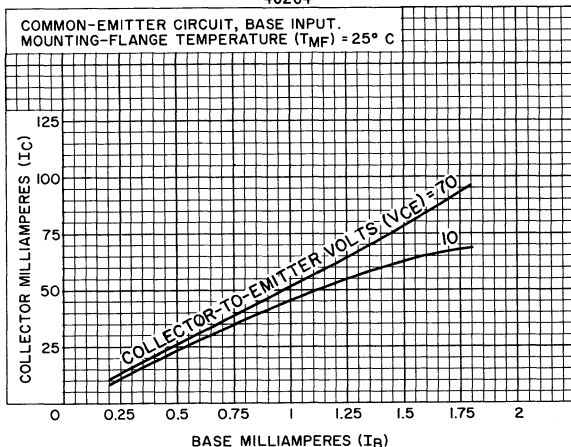
40264



92CS-12721

Typical Static Beta (h_{FE}) Characteristics

40264



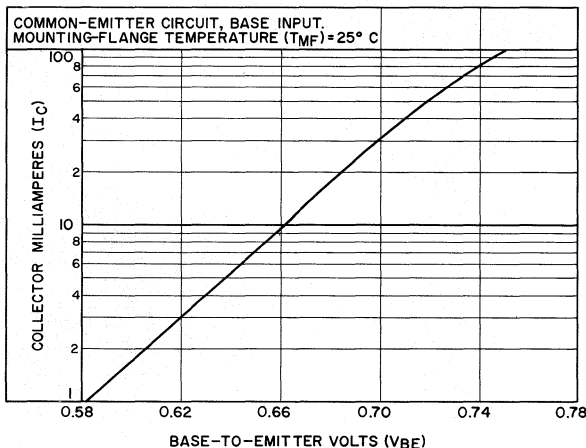
92CS-12722



40261 to 40265

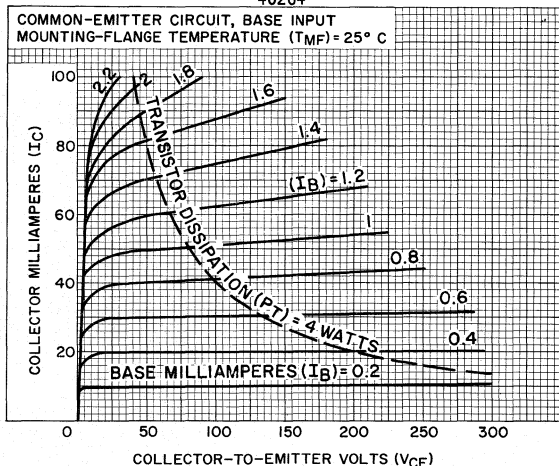
Typical Transfer Characteristics

40264



Typical Collector Characteristics

40264



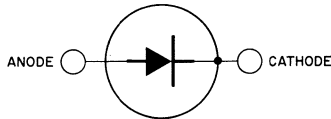
Silicon Rectifiers

DIFFUSED-JUNCTION TYPES

For Power Supplies in Transistor High-Fidelity Amplifiers
and other Industrial and Consumer-Product Applications
Requiring Large DC Supply Currents at Low Voltages

Dimensions. See accompanying Dimensional Outline

Terminal Diagram:



The arrow indicates direction of forward current as indicated by dc ammeter.

RECTIFIER SERVICE

MAXIMUM RATINGS, Absolute-Maximum Values

For supply frequency of 60 c/s with capacitor-input filter

	40266	40267	
Peak Reverse Voltage. PRV	100	200	V
RMS Supply Voltage. V_{RMS}	35	70	V
Forward Current			
At case temperatures up to 105° C:			
DC. I_F	2	2	A
Peak repetitive. i_{PR}	10	10	A
Surge ^a i_S	35	35	A
At case temperatures above 105° C. See Rating Chart			
At free-air temperatures up to 75° C:			
DC. I_F	500	500	mA ←
Peak repetitive. i_{PR}	5	5	A
Surge ^a i_S	35	35	A
At free-air temperatures above 75° C. See Rating Chart			
Temperature Range			
Operating (Free-air) T_{opr}	-65 to 110	-65 to 110	°C
Operating (Case) T_{opr}	-65 to 135	-65 to 135	°C
Storage. T_{stg}	-65 to 150	-65 to 150	°C
Lead-Soldering Temperature. . . T_L	255	255	°C
(For 10 sec. max.) ^b			

Indicates a change. ←



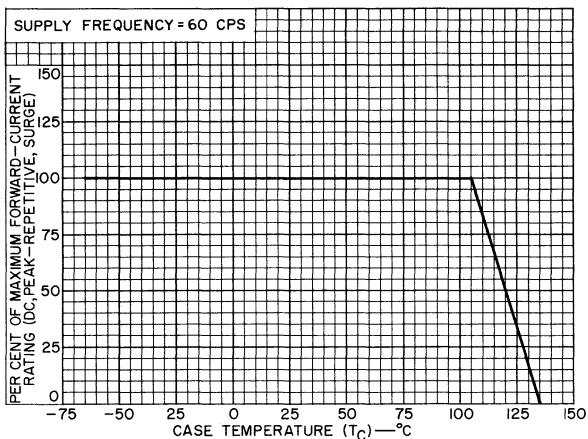
RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

DATA 1
5-65

40266, 40267

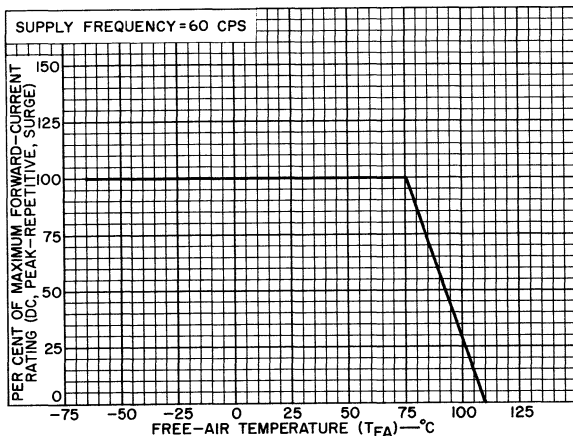
Rating Charts

40266



92CS-12709

40267



92CS-12710



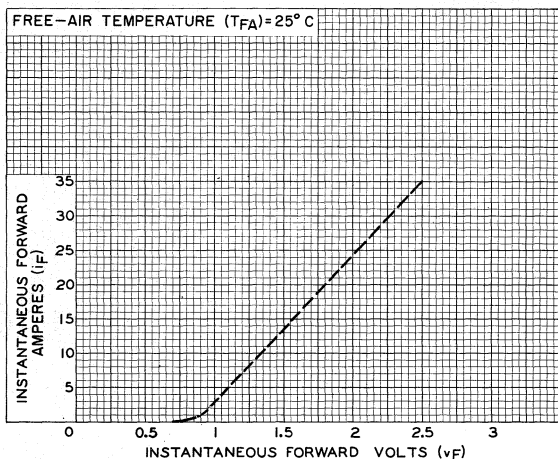
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DATA 2
10-64

40266, 40267

Typical Forward Voltage and Current Characteristic

40266, 40267



92CS-9730R3



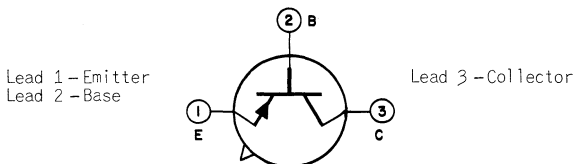
Transistor

GERMANIUM P-N-P ALLOY-JUNCTION TYPE

*For Medium-Speed Switching Applications in
Industrial and Military Data-Processing Equipment*

Dimensions. See Outline TO-5 in General Section

Terminal Diagram: **BOTTOM VIEW**



SWITCHING SERVICE

MAXIMUM RATINGS, Absolute-Maximum Values

Collector-to-Base Voltage V_{CBV} -25 V

$V_{EB} = -1$ V

Emitter-to-Base Voltage V_{EBO} -12 V

Collector Current I_C -100 mA

Emitter Current I_E 100 mA

Transistor Dissipation

At free-air temperatures:

From -65° to 25° C. P_T 150 mW

Above 25° C. Derate linearly to 0 W at 85° C

Temperature Range

Operating (Junction) T_{opr} -65 to 85 $^{\circ}$ C

Storage. T_{stg} -65 to 100 $^{\circ}$ C

Lead-Soldering Temperature^a T_L 230 $^{\circ}$ C

(For 10 sec. max.)

ELECTRICAL CHARACTERISTICS

*Unless otherwise specified, electrode-voltage
and electrode-current values for given test
conditions are dc at case temperature = 25° C*

		Min	Max	
Collector-to-Base				
Breakdown Voltage.	BV_{CB0}	-25	-	V
$V_{EB} = -1$ V, $I_C = -0.02$ mA				

Emitter-to-Base				
Breakdown Voltage.	BV_{EBO}	-12	-	V
$I_E = -0.02$ mA, $I_C = 0$				



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DATA 1
5-65

Min. Max.

Base-to-Emitter**Saturation Voltage** $I_C = -12 \text{ mA}$, $I_B = -0.4 \text{ mA}$. . $V_{BE}(\text{sat})$

- -0.35 V

 $I_C = -24 \text{ mA}$, $I_B = -1 \text{ mA}$. . $V_{BE}(\text{sat})$

- -0.4 V

Collector-to-Emitter**Saturation Voltage** $V_{CE}(\text{sat})$

- -0.2 V

 $I_C = -24 \text{ mA}$, $I_B = -1 \text{ mA}$ **Collector-Cutoff Current** $V_{CB} = -12 \text{ V}$, $I_E = 0$, $T_F = 25^\circ \text{ C}$ I_{CB0} - -5 μA $T_F = 80^\circ \text{ C}$ I_{CB0} - -90 μA **Emitter-Cutoff Current** I_{EB0} - -2.5 μA $V_{EB} = -2.5 \text{ V}$, $I_C = 0$ **DC Forward Current****Transfer Ratio** h_{FE}

50 200

 $V_{CE} = -0.15 \text{ V}$, $I_C = -12 \text{ mA}$ **Small-Signal Forward-Current****Transfer-Ratio Cutoff Frequency** f_{hfb}

4 - Mc/s

 $V_{CB} = -6 \text{ V}$, $I_C = -1 \text{ mA}$ **Collector Capacitance** C_C

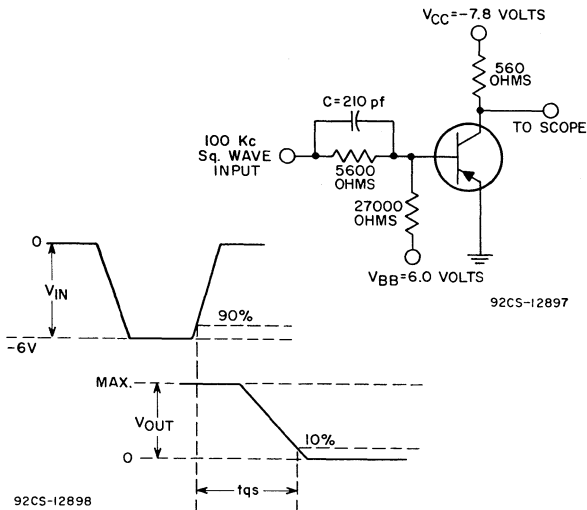
- 20 pF

 $V_{CB} = -6 \text{ V}$, $I_C = 0$ **Stored Base Charge^b** Q_S

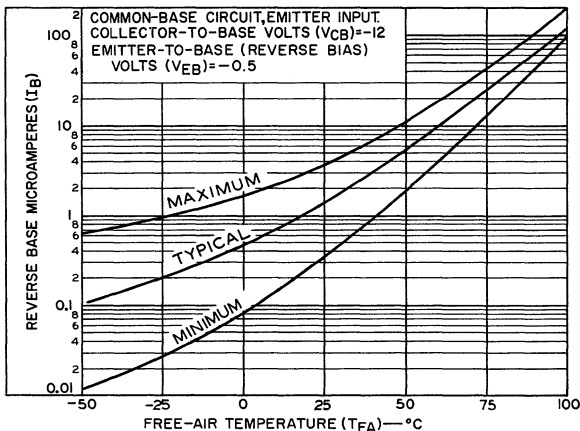
- 1200 pC

 $I_C = -10 \text{ mA}$, $I_B = -1 \text{ mA}$ ^a Measured along lead at distances not less than 1/32" from seating plane.^b See accompanying *Stored Base Charge Test Circuit*.

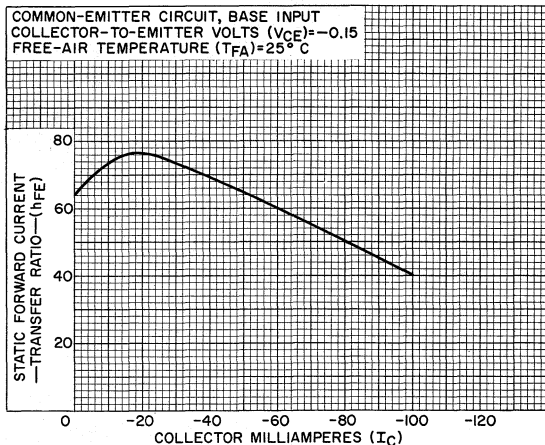
STORED BASE CHARGE TEST CIRCUIT



Reverse Characteristics

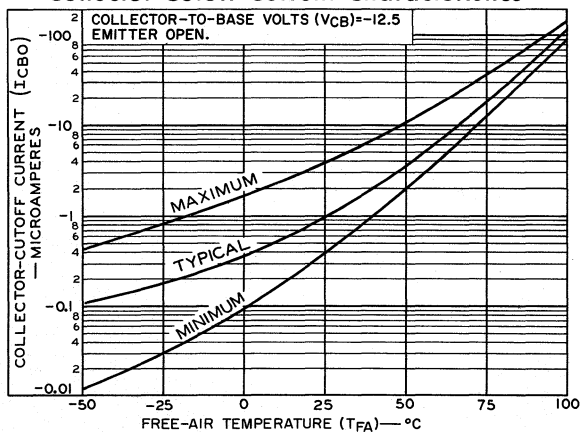


Typical DC Forward-Current Transfer-Ratio Characteristic



92CS-12900

Collector-Cutoff Current Characteristics



92CS-10885R2



Transistor

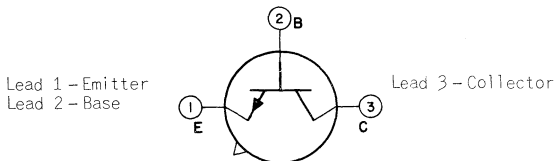
SILICON N-P-N "OVERLAY" EPITAXIAL-PLANAR TYPE

For Ultra-High Reliability, Large-Signal, High-Power, VHF-UHF Applications in Space, Industrial, and Military Communications Equipment for Class-A, -B, or -C Amplifier, Frequency Multiplier, or Oscillator Operation

Dimensions. See Outline TO-60 in General Section

Terminal Diagram:

BOTTOM VIEW



RADIO-FREQUENCY SERVICE

MAXIMUM RATINGS, Absolute-Maximum Values

Collector-to-Base Voltage	V _{CB0}	65	volts
Collector-to-Emitter Voltage			
With V _{BE} = -1.5 volts	V _{CEV}	65	volts
With base open.	V _{CE0}	40	volts
Emitter-to-Base Voltage	V _{EB0}	4	volts
Collector Current	I _C	1.5	amp

Transistor Dissipation

At case temperatures

From -65° to 25° C. P_T 11.6 watts

Above 25° C. Derate linearly to 0 watts at 200° C

Temperature Range

Operating (Junction). T_{opr} -65 to 200 °C

Storage T_{stg} -65 to 200 °C

Lead-Soldering Temperature^a T_L 230 °C
(For 10 sec. max.)

ELECTRICAL CHARACTERISTICS

Unless otherwise specified, electrode-voltage and electrode-current values for given test conditions are dc at case temperature = 25° C

Min. Max.

Collector-to-Base Breakdown Voltage	BV _{CB0}	65	-	volts
I _C = 0.1 ma, I _E = 0				



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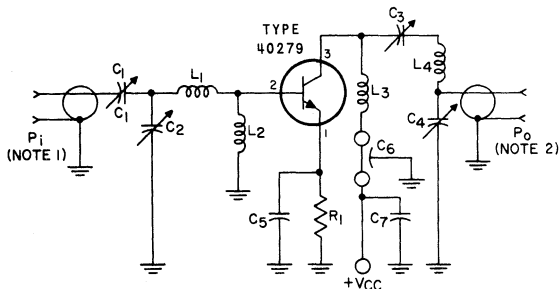
DATA 1
4-65

Min. Max.

Collector-to-Emitter**Breakdown Voltage** I_C (Pulsed) = 0 to 200 ma, ^b $V_{BE} = -1.5$ volts. BV_{CEV} 65^c - volts I_C (Pulsed) = 0 to 200 ma, ^b $I_B = 0$ BV_{CEO} 40^c - volts**Emitter-to-Base****Breakdown Voltage** BV_{EBO} 4 - volts $I_E = 0.1$ ma, $I_C = 0$ **Collector-to-Emitter****Saturation Voltage**. $V_{CE(sat)}$ - 1 volt $I_C = 0.5$ amp, $I_B = 100$ ma**Collector-Cutoff Current**. I_{CEO} - 0.1 μ a $V_{CE} = 30$ volts, $I_B = 0$ **DC Forward-Current****Transfer Ratio**. h_{FE} 10 - $V_{CE} = 5$ volts, $I_C = 150$ ma**Output Capacitance**. C_{ob} - 10 pf $f = 1$ Mc, $V_{CB} = 30$ volts, $I_E = 0$ **RF Power Output Amplifier,****Unneutralized^d** $f = 100$ Mc, $V_{CE} = 28$ volts, $P_i = 1$ watt P_o 7.5^e - watts $f = 400$ Mc, $V_{CE} = 28$ volts, $P_i = 1$ watt P_o 3^f - watts^a Measured along lead at distances not less than 1/32" from insulating wafer.^b Pulsed through an inductor (25 mh); duty factor = .5.^c Measured at a current where the breakdown voltage is a minimum.^d See accompanying *Power-Output-Measurement Circuits*.^e For conditions given, minimum efficiency = 65 per cent.^f For conditions given, typical efficiency = 40 per cent.

POWER-OUTPUT MEASUREMENT CIRCUITS

Unneutralized RF Amplifier, 100 Mc



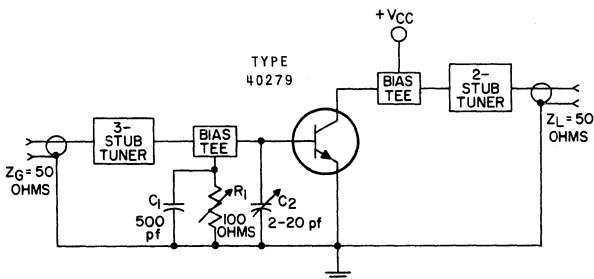
Note 1: Generator Impedance = 50 ohms.

Note 2: Load Impedance = 50 ohms.

For 100-Mc Operation

C ₁ , C ₂ : 7-100 pf	L ₁ : 3 turns No.16 wire, 1/4" ID, 5/16" long
C ₃ , C ₄ : 4-40 pf	L ₂ : Ferrite choke, Z = 750 (±20%) ohms
C ₅ : 330 pf, disc ceramic	L ₃ : 2.4-μh choke
C ₆ : 1500 pf	L ₄ : 5 turns No.16 wire, 5/16" ID, 7/16" long
C ₇ : 0.005 μf, disc ceramic	R ₁ : 1.35 ohms, non-inductive

Unneutralized RF Amplifier, 400 Mc



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DATA 2
4-65

**All Characteristics Curves
shown under type 2N3375 also apply to the 40279**

RELIABILITY TESTING

In addition to Preconditioning and Group A tests, a Qualification Approval test series (Group B Tests) is performed on a semi-annual basis. All units are tested to assure freedom from second breakdown in Class-A applications.

Preconditioning (100 Per Cent Testing of Each Transistor)

1. Serialization
2. Record I_{CEO} , h_{FE} , $V_{CE(sat)}$
3. Temperature Cycling—Method 102A of MIL-STD-202, 5 cycles, -65°C $+200^{\circ}\text{C}$
4. Bake, 72 hours minimum, $+200^{\circ}\text{C}$
5. Constant Acceleration—Method 2006 of MIL-STD-750, 10, 000G, Y_1 and Y_2 axes
6. Record I_{CEO} , h_{FE} , $V_{CE(sat)}$
7. Reverse Bias Age, $T_{FA} = 150^{\circ}\text{C}$, $V_{CB} = 28$ volts, $t = 168$ hours
- 8.⁹ Record I_{CEO} , h_{FE} , $V_{CE(sat)}$
9. Power Age, $T_{FA} = 25^{\circ}\text{C}$, $V_{CB} = 28$ volts, $t = 500$ hours, $P_D = 2.6$ watts, free air
- 10.⁹ Record I_{CEO} , h_{FE} , $V_{CE(sat)}$ at 168 hours and 500 hours
11. Helium Leak, 1×10^{-8} cc/sec. max.
12. Methanol Bomb, 70 psig, 18 to 24 hours
13. X-Ray, RCA Spec. 1750326
14. Record Subgroups 2 and 3 of Group A Tests

- ⁹ Delta criteria after 168 hours Reverse Bias Age and after 168 hours and 500 hours Power Age

ΔI_{CEO}	$+100\%$ or $+10$ nanoamperes whichever is greater
Δh_{FE}	$\pm 30\%$
$\Delta V_{CE(sat)}$	± 0.1 volts



Group A Tests

TEST METHOD ^h	EXAMINATION OR TEST & CONDITIONS	LIMITS		
		MIN.	MAX.	
SUBGROUP 1 — LTPD-10				
2071	Visual and Mechanical Examination			
SUBGROUP 2 — LTPD-5				
3036D	Collector-to-Emitter Cutoff Current.	I_{CEO}	-	100 na
	$V_{CE} = 30$ volts, $I_B = 0$			
3001D	Collector-to-Base Breakdown Voltage. . . .	BV_{CBO}	65	- volts
	$I_C = 100 \mu a$, $I_E = 0$			
3026B	Emitter-to-Base Breakdown Voltage. . . .	BV_{EBO}	4	- volts
	$I_E = 100 \mu a$, $I_C = 0$			
3011D	Collector-to-Emitter Breakdown Voltage. . . .	BV_{CEO}	40	- volts
	$I_C = 0$ to 200 ma (Inductive), $I_B = 0$			
3011A	Collector-to-Emitter Breakdown Voltage. . . .	BV_{CEV}	65	- volts
	$I_C = 0$ to 200 ma (In- ductive), $V_{BE} = -1.5$ volts			
3071	Collector-to-Emitter Saturation Voltage. . . .	$V_{CE(sat)}$	-	1 volt
	$I_C = 500$ ma, $I_B = 100$ ma			
3076	Forward Current Transfer Ratio	h_{FE}	10	-
	$I_C = 150$ ma, $V_{CE} = 5$ volts			
SUBGROUP 3 — LTPD-5				
3236	Output Capacitance. . . .	C_{ob}	-	10 pf
	$f = 140$ kc, $V_{CB} = 30$ volts, $I_E = 0$			
j	RF Power Output (Min. eff. = 65%)	P_O	7.5	- watts
	$V_{CE} = 28$ volts, $P_i = 1$ watt, $f = 100$ Mc			
k	RF Power Output (Min. eff. = 40%)	P_O	3	- watts
	$V_{CE} = 28$ volts, $P_i = 1$ watt, $f = 400$ Mc			
SUBGROUP 4 — LTPD-15				
3036D	Collector Cutoff Current. .	I_{CBO}	-	100 μa
	$T_{FA} = 150^\circ C \pm 3^\circ C$, $V_{CB} = 30$ volts, $I_E = 0$			
3076	Forward Current Transfer Ratio.	h_{FE}	-	200
	$T_{FA} = 150^\circ C \pm 3^\circ C$, $I_C = 150$ ma, $V_{CE} = 5$ volts			

^h Per Mil-Std-750.^j See circuit, Unneutralized RF Amplifier, 100 Mc.^k See circuit, Unneutralized RF Amplifier, 400 Mc.

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Electronic Components and Devices

Harrison, N. J.

DATA 3
4-65

Group B Tests^m - Made every 6 mos. as part of Qualification Approval

TEST METHOD ^h	EXAMINATION OR TEST & CONDITIONS	LIMITS	
		MIN.	MAX.
SUBGROUP 1 — LTPD-7 (10 Samples)			
2066	Physical Dimensions T0-60	-	-
202/102A	Temperature Cycle 5 cps, -65° C, 200° C	-	-
1056B	Thermal Shock 0° C, 100° C	-	-
1021	Moisture Resistance Omit lead fatigue	-	-
2036D	Torque-to-Stud 1 minute, 12 inch pounds	-	-
SUBGROUP 2 — LTPD-7 (10 Samples)			
2016	Impact Shock 500 g, 5 blows, X _I , Y _I , Z _I , 1 msec	-	-
2046	Vibration Fatigue	-	-
2056	Vibration Variable Freq.	-	-
SUBGROUP 3 — LTPD-7 (10 Samples)			
2026	Solderability	-	-
1066	Dew Point 25° C -65° C; read I _{CEO}	-	-
1001	Barometric Pressure 100,000 ft.; read I _{CEO}	-	-
SUBGROUP 4 — LTPD-7 (25 Samples)			
1031	Storage Life 200° C, 1000 hrs	-	-
2006	Constant Acceleration 20,000 g, Y _I , Y ₂	-	-
SUBGROUP 5 — LTPD-7 (25 Samples)			
1026	Operating Life 1000 hrs, T _C = 140° C, V _{CB} = 28 volts, P _D = 4 watts	-	-
END POINTS — SUBGROUPS 1,2,3,4,5			
3036D	Collector-Cutoff Current . . . I _{CEO} V _{CE} = 30 volts, I _B = 0	-	1 μ a
3011A	Collector-to-Emitter Breakdown Voltage BV _{CEV} I _C = 0 to 200 ma (Inductive), V _{BE} = -1.5 volts	60	- volts
	RF Power Output. P _O f = 100 Mc, V _{CE} = 28 volts, P _i = 1 watt	6.5	- watts
3076	Forward Current Transfer Ratio I _C = 150 ma, V _{CE} = 5 volts	h _{FE} 9	-
3026D	Emitter-to-Base Breakdown Voltage BV _{EBO} I _E = 100 μ a, I _C = 0	3.5	- volts

^m Acceptance/Rejection Criteria of Group B tests: For LTPD plan of 7% the total sample size is 80 for which the maximum number of rejects allowed is 2. Acceptance is also subject to a minimum of one (1) reject per Subgroup.



40280, 40281, 40282

Transistor

SILICON N-P-N "OVERLAY" EPITAXIAL-PLANAR TYPE

*For Low Supply Voltage, High Power Output,
VHF Class-C Amplifier Service in Military
and Industrial Communications Equipment*

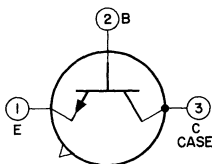
Dimensions:

40280 See Outline TO-39 in General Section
40281, 40282. See Outline TO-60 in General Section

Terminal Diagrams:

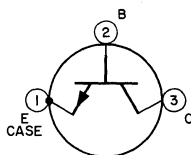
BOTTOM VIEW

40280



Lead 1 - Emitter
Lead 2 - Base
Lead 3 - Collector, Case

40281, 40282



Pin 1 - Emitter, Case
Pin 2 - Base
Pin 3 - Collector

RADIO-FREQUENCY SERVICE

MAXIMUM RATINGS, Absolute-Maximum Values

	40280	40281	40282
Collector-to-Base Voltage . . V_{CB0}	36	36	36 volts
Collector-to-Emitter Voltage			
With $V_{BE} = -1.5$ volts . . . V_{CEV}	36	36	36 volts
With base open. V_{CEO}	18	18	18 volts
Emitter-to-Base Voltage . . . V_{EB0}	4	4	4 volts
Collector Current. I_C	0.5	1	2 amp
Transistor Dissipation			
At case temperatures:			
From -65° to 25° C P_T	7	11.6	23.2 watts
Above 25° C. Derate linearly to 0 watts at 200° C			
Temperature Range			
Operating (Junction). . . . T_{opr}	-65 to 200		$^{\circ}$ C
Storage T_{stg}	-65 to 200		$^{\circ}$ C
Lead- or Pin-Soldering			
Temperature ^a T_L or T_p	230	230	230 $^{\circ}$ C
(For 10 sec. max.)			



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DATA 1
4-65

ELECTRICAL CHARACTERISTICS

Unless otherwise specified, electrode-voltage and electrode-current values for given test conditions are dc at case temperature = 25°C

40280 40281 40282

Collector-to-Base Breakdown Voltage

$I_C = 0.25$ ma, $I_E = 0$	BV_{CBO}	36	36	-	min. volts
$I_C = 0.50$ ma, $I_E = 0$	BV_{CBO}	-	-	36	min. volts

Collector-to-Emitter Breakdown Voltage

I_C (Pulsed) = 200 ma ^b , $V_{BE} = -1.5$ volts	BV_{CEV}	36	36	36	min. volts
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Emitter-to-Base Breakdown Voltage

$I_E = 0.10$ ma, $I_C = 0$	BV_{EBO}	4	4	-	min. volts
$I_E = 0.25$ ma, $I_C = 0$	BV_{EBO}	-	-	4	min. volts

Collector-to-Emitter Sustaining Voltage

I_C (Pulsed) = 200 ma ^b , $I_B = 0$	$V_{CEO}(sus)$	18	18	18	min. volts
--	----------------	----	----	----	------------

Collector-Cutoff Current

$V_{CE} = 15$ volts, $I_B = 0$	I_{CEO}	100	100	250	max. μa
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Real Part of Common-Emitter

(High Frequency Input Impedance)

$f = 175$ Mc, $V_{CE} = 13.5$ volts,

$I_C = 100$ ma	$h_{ie}(real)$	10	-	-	typ. ohms
$I_C = 400$ ma	$h_{ie}(real)$	-	7	-	typ. ohms
$I_C = 800$ ma	$h_{ie}(real)$	-	-	5	typ. ohms

Output Capacitance

$f = 1$ Mc, $V_{CB} = 13.5$ volts, $I_E = 0$	C_{ob}	15	22	45	max. pf
--	----------	----	----	----	---------

Collector-to-Case Capacitance

	C_S	-	5	5	max. pf
--	-------	---	---	---	---------

Gain-Bandwidth Product

$V_{CE} = 13.5$ volts,

$I_C = 100$ ma	f_T	550	-	-	typ. Mc
$I_C = 400$ ma	f_T	-	400	-	typ. Mc
$I_C = 800$ ma	f_T	-	-	350	typ. Mc

RF Power Output, Class-C Amplifier, Unneutralized^c

$f = 175$ Mc, $V_{CE} = 13.5$ volts,

$P_i = 0.125$ watt	P_o	I_d	-	-	min. watt
$P_i = 1$ watt	P_o	-	4^e	-	min. watts
$P_i = 4$ watts	P_o	-	-	12^f	min. watts

Thermal Resistance

Junction-to-Case	θ_{JC}	25	15	7.5	max. °C/watt
------------------	---------------	----	----	-----	--------------

^a Measured from seating plane (for 40280) or at distances $\geq 1/32$ from insulating wafer (for 40281, 40282).

^b Pulsed through an inductor (25 mh); duty factor = 0.5.

^c See accompanying Power-Output-Measurement Circuit.

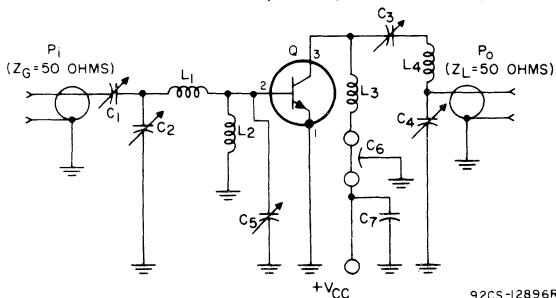
^d For conditions given, minimum efficiency = 60 per cent.

^e For conditions given, minimum efficiency = 70 per cent.

^f For conditions given, minimum efficiency = 80 per cent.



POWER-OUTPUT MEASUREMENT CIRCUITS Unneutralized RF Amplifier, 50- & 175-Mc



92CS-12896RI

For 50-Mc Operation

Q = 40280

- C1, C4: 14-150 pf
C2: 24-200 pf
C3: 7-100 pf
C5: Not used
C6: 1,000 pf
C7: 0.01 μ f
L1: 4 turns No. 16 wire,
1/4" ID, 5/16" long
L2: Ferrite choke, Z =
450 ohms
L3: RF choke, 7 μ h
L4: 8 turns No. 16 wire,
3/8" ID, 5/8" long

Q = 40281, 40282

- C1, C3: 24-200 pf
C2, C4: 32-250 pf
C5: Not used
C6: 1,000 pf
C7: 0.01 μ f
L1: 3 turns No. 16 wire,
1/4" ID, 5/16" long
L2: Ferrite choke, Z =
450 ohms
L3: 5 turns No. 16 wire,
7/16" ID, 1/2" long
L4: 6 turns No. 16 wire,
3/8" ID, 1/2" long

For 175-Mc Operation

Q = 40280

- C1, C2, C3, &
C4: 3-30 pf
C5: Not used
C6: 1,000 pf
C7: 0.01 μ f
L1: 2 turns No. 16 wire,
3/16" ID, 1/4" long
L2: Ferrite choke, Z =
450 ohms
L3: 2 turns No. 16 wire,
1/4" ID, 1/4" long
L4: 4 turns No. 16 wire,
3/8" ID, 3/8" long

Q = 40281, 40282

- C1, C2, C3, &
C4: 7-100 pf
C5: 8-60 pf
C6: 1,000 pf
C7: 0.01 μ f
L1: 3 turns No. 16 wire,
3/16" ID, 5/16" long
L2: Ferrite choke, Z =
450 ohms
L3: 1 turn No. 16 wire,
1/4" ID, 3/8" long
L4: 2 turns No. 16 wire,
1/4" ID, 1/4" long

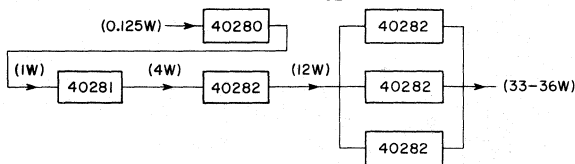


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DATA 2
4-65

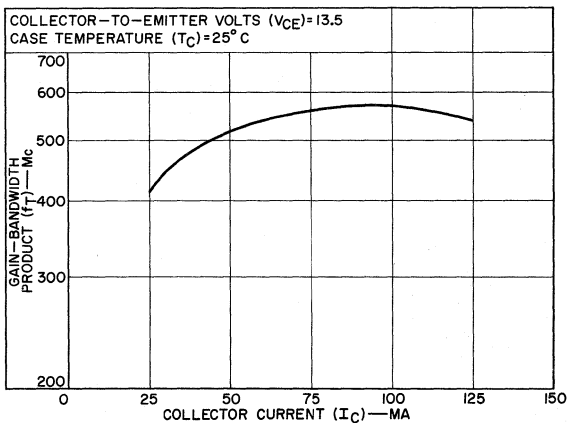
40280,40281,40282

TYPICAL 175-Mc AMPLIFIER CHAIN FOR P_0
OF 33 TO 36 WATTS AT $V_{CE} = 13.5$ VOLTS



92CS-12887

Gain-Bandwidth Product vs. Collector Current 40280

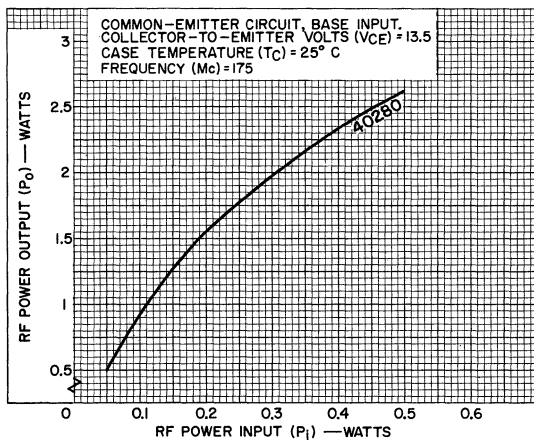
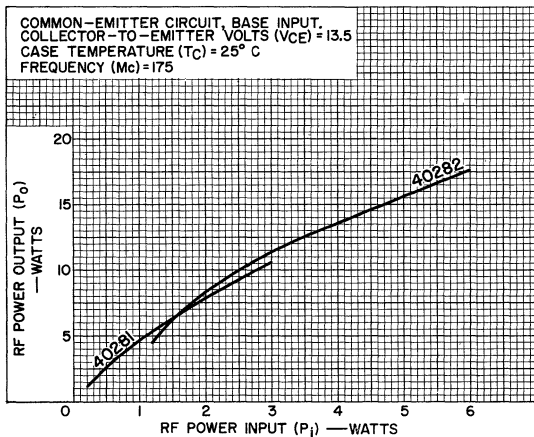


92CS-12895



RF Power Output vs. RF Power Input

175-Mc Operation

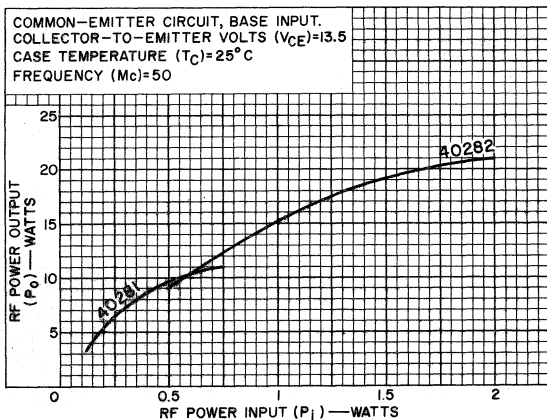


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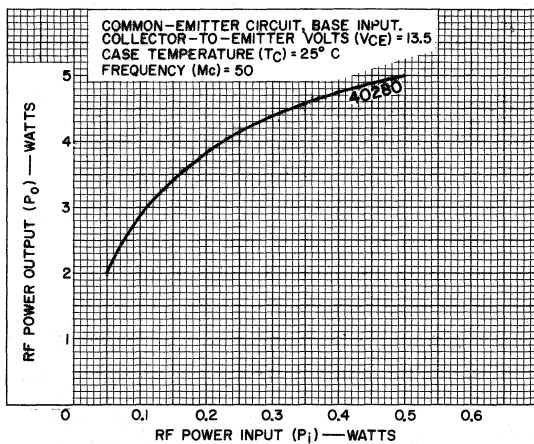
DATA 3
4-65

RF Power Output vs. RF Power Input

50-Mc Operation



92CS-12889



92CS-12894

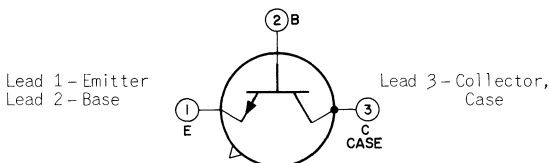
Transistor

SILICON N-P-N DOUBLE-DIFFUSED-JUNCTION EPITAXIAL-PLANAR TYPE

*For Core-Driver and Line-Driver Service in High-
Performance Computers and in Other Critical
Applications Requiring Considerable Output Power*

Dimensions See Outline TO-46 in General Section

Terminal Diagram: **BOTTOM VIEW**

**MAXIMUM RATINGS, Absolute-Maximum Values**

Collector-to-Base Voltage.	V_{CB0}	60	volts
Collector-to-Emitter Voltage.	V_{CE0}	30	volts
Emitter-to-Base Voltage.	V_{EB0}	5	volts
Collector Current.	I_C	Limited by power dissipation	

Transistor Dissipation

At case temperatures with heat sink:^a

From -65° to 25° C	P_T	2	watts
Above 25° C.	Derate linearly to 0 watts at 200° C		

At free-air temperatures

From -65° to 25° C	P_T	0.4	watt
Above 25° C.	Derate linearly to 0 watts at 200° C		

Temperature Range

Operating (Junction).	T_{opr}	-65 to 200	$^{\circ}$ C
Storage.	T_{stg}	-65 to 200	$^{\circ}$ C

Lead-Soldering Temperature^b T_L 230 $^{\circ}$ C
(For 10 sec. max.)

ELECTRICAL CHARACTERISTICS

*Unless otherwise specified, electrode-voltage
and electrode-current values for given test
conditions are dc at free-air temperature = 25° C*

Min. Typ. Max.

Collector-to-Base Breakdown

Voltage	BV_{CB0}	60	-	-	volts
$I_C = 0.01$ ma, $I_E = 0$					

^a Measured at center of seating surface.

^b Measured along lead at distances not less than $1/32$ " from seating surface.



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DATA 1
4-65

		Min.	Typ.	Max.	
Collector-to-Emitter Breakdown Voltage	BV_{CE0}	30	-	-	volts
$I_C = 50$ ma, $I_B = 0$					
Emitter-to-Base Breakdown Voltage	BV_{EB0}	5	-	-	volts
$I_E = 0.1$ ma, $I_C = 0$					
Base-to-Emitter Voltage					
$I_C = 150$ ma, $I_B = 7.5$ ma. . .	V_{BE}	-	0.82	1	volt
$I_C = 500$, $I_B = 50$ ma.	V_{BE}	-	1.16	1	volts
Collector-to-Emitter Saturation Voltage					
$I_C = 150$ ma, $I_B = 7.5$ ma. . .	$V_{CE(sat)}$	-	0.28	0.4	volt
$I_C = 500$ ma, $I_B = 50$ ma. . . .	$V_{CE(sat)}$	-	0.45	1	volt
Base-Cutoff Current	I_{BEV}	-	-	0.5	μ a
$V_{CE} = 30$ volts, $V_{EB} = 0.3$ volt					
Collector-Cutoff Current					
$V_{CE} = 30$ volts, $V_{EB} = 0.3$ volt,	I_{CEV}	-	-	0.5	μ a
$T_{FA} = 25^\circ$ C.	I_{CEV}	-	-	100	μ a
$T_{FA} = 100^\circ$ C.					
DC Forward-Current Transfer Ratio^c	h_{FE}	10	-	-	
$V_{CE} = 1$ volt, I_C (Pulsed) = 500 ma					
Output Capacitance	C_{ob}	-	5.8	10	pf
$f = 0.14$ Mc, $V_{CB} = 10$ volts, $I_E = 0$					
Small-Signal Forward-Current Transfer Ratio	h_{fe}	2.5	3.75	-	
$f = 100$ Mc, $V_{CE} = 10$ volts, $I_C = 50$ ma					
Turn-On Time ($t_d + t_r$)^d	t_{on}	-	16	30	nsec
$I_C = 150$ ma, $I_{B1} = 15$ ma, $I_{B2} = -15$ ma					
Storage Time^e	t_s	-	17	30	nsec
$I_C = 150$ ma, $I_{B1} = 15$ ma					
Turn-Off Time ($t_s + t_f$)^e	t_{off}	-	27	45	nsec
$I_C = 150$ ma, $I_{B1} = 15$ ma, $I_{B2} = -15$ ma					

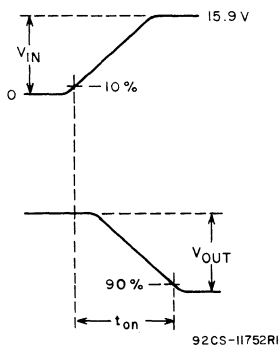
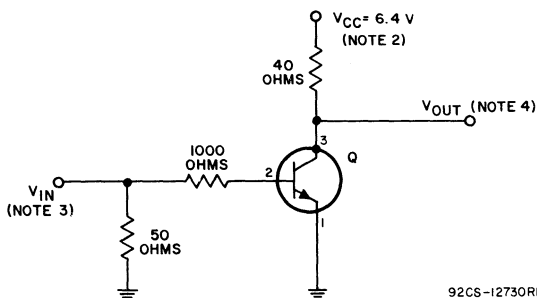
^c Pulse duration ≤ 400 μ seconds, duty factor ≤ 0.03 .

^d See accompanying Circuit Used to Measure Turn-On Time (t_{on}).

^e See accompanying Circuit Used to Measure Turn-Off Time (t_{off}) and Storage Time (t_s).

In addition to the accompanying Switching Curves
All Characteristic Curves shown under
type 2N3512 also apply to the 40283

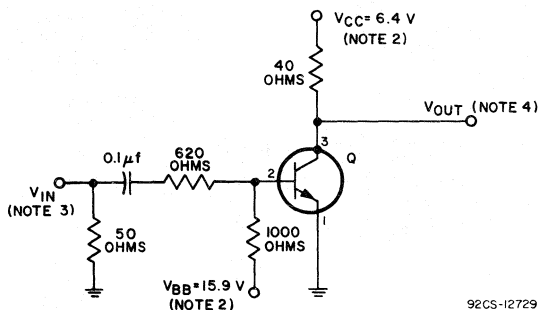


CIRCUIT USED TO MEASURE TURN-ON TIME (t_{on})

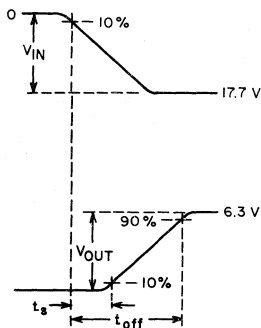
For Notes, see next page.



CIRCUIT USED TO MEASURE TURN-OFF TIME (t_{off})
AND STORAGE TIME (t_s)



Q = 40283



Note 1: All resistance values have $\pm$ per cent tolerance.

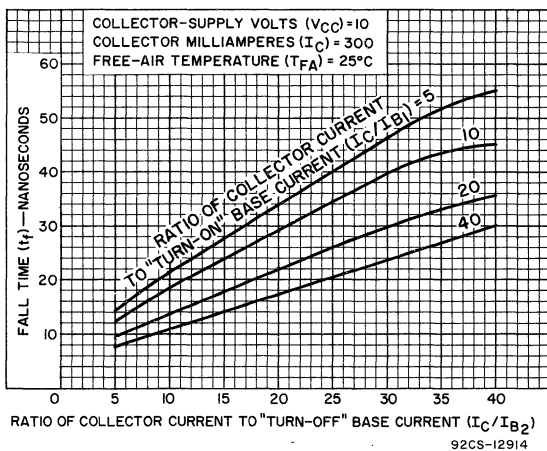
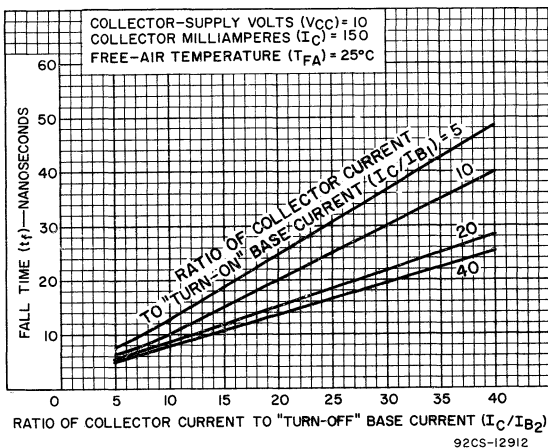
Note 2: With certain types of power supplies, it may be necessary to connect 25- μ f decoupling capacitors across the power-supply terminals for V_{CC} and V_{BB} .

Note 3: Input voltage (V_{IN}) obtained from mercury-relay type pulse generator having an output impedance of 50 ohms. V_{IN} rise time < 2 nsec; pulse duration > 150 nsec; and duty factor $< 2\%$.

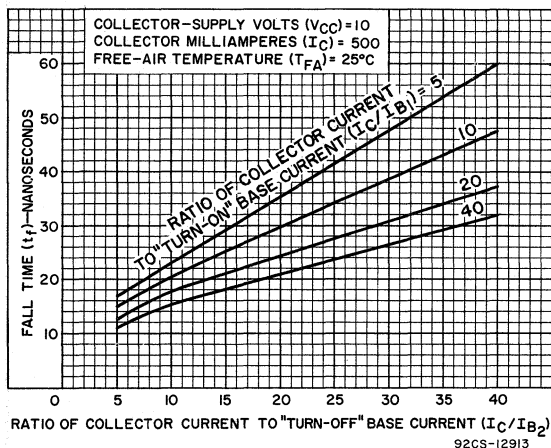
Note 4: Input and output wave forms monitored by means of a sampling oscilloscope having a rise time < 0.5 nsec; input capacitance of probe < 2.5 pf with shunt resistance of 1 megohm.



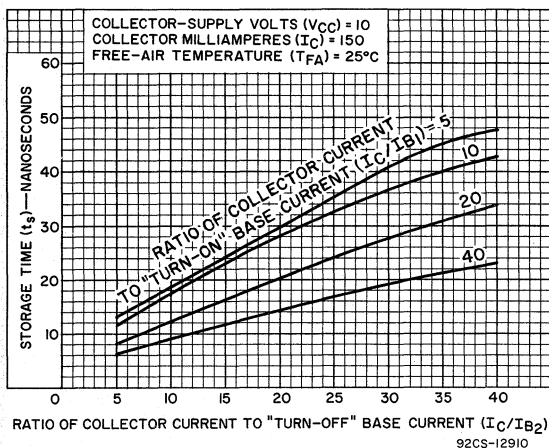
Typical Fall-Time (t_f) Characteristics



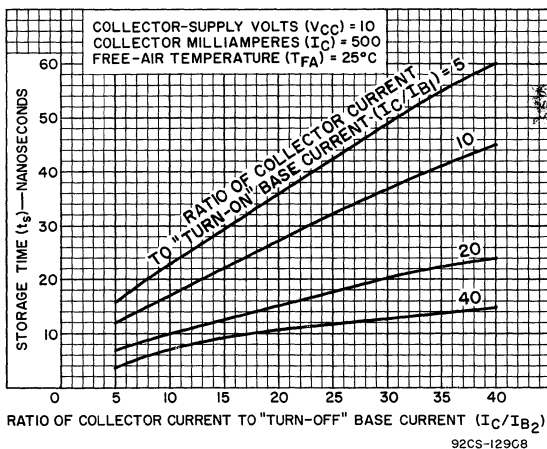
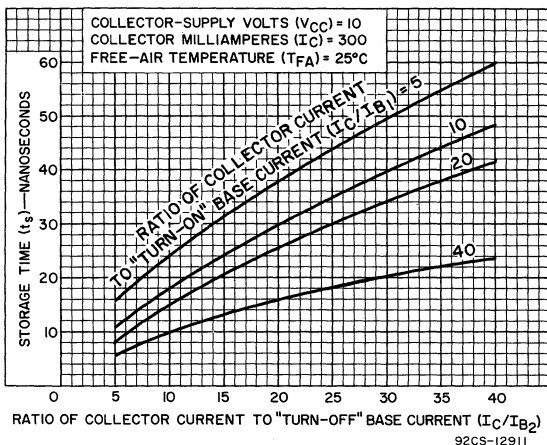
Typical Fall-Time (t_f) Characteristics



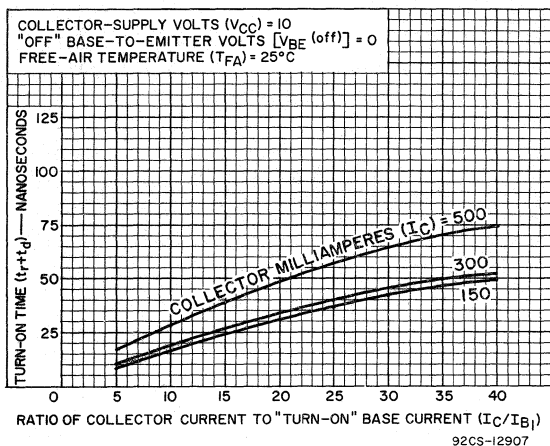
Typical Storage Time (t_s) Characteristics



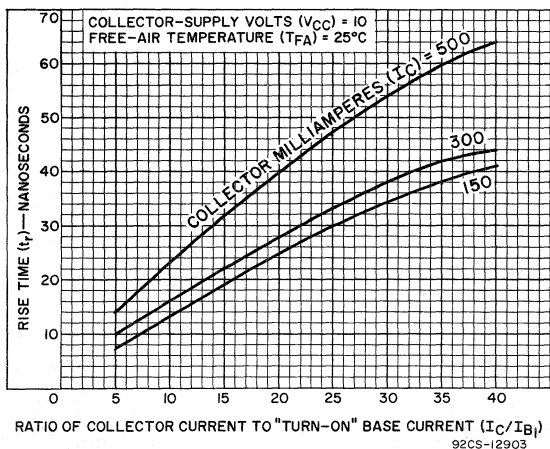
Typical Storage Time (t_s) Characteristics



Typical "Turn-On" Time (t_{on}) Characteristics



Typical Rise Time (t_r) Characteristics



40290, 40291, 40292

Transistors

SILICON N-P-N "OVERLAY" EPITAXIAL-PLANAR TYPES

For Low Supply Voltage, High Power Output, Amplitude Modulated, VHF Class-C Amplifier Service in Aircraft, Military, and Industrial Communications Equipment

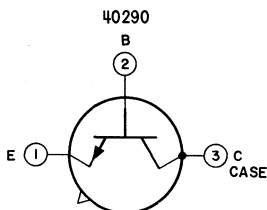
Dimensions:

40290 See Outline TO-39 in General Section

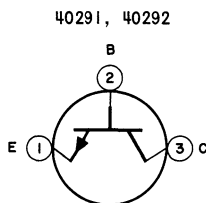
40291, 40292 See Outline TO-60 in General Section

Terminal Diagrams:

BOTTOM VIEWS



Lead 1—Emitter
Lead 2—Base
Lead 3—Collector, Case



Pin 1—Emitter
Pin 2—Base
Pin 3—Collector

RADIO-FREQUENCY SERVICE

MAXIMUM RATINGS, Absolute-Maximum Values

		40290	40291	40292	
Collector-to-Emitter Voltage					
$V_{BE} = -1.5 \text{ V}$	V_{CEX}	50	50	50	V
$F = 100 \text{ Mc/s.}$	$V_{CES(RF)}$	90	90	90	V
Emitter-to-Base Voltage.					
	V_{EB0}	4	4	4	V
Collector Current.					
	I_C	0.5	0.5	1.25	A
Transistor Dissipation					
At case temperatures:					
From -65° to 25°C.	P_T	7	11.6	23.2	W
Above 25°C.	Derate linearly to 0 watts at 200°C				
Temperature Range					
Operating (Junction)	T_{opr}	-65 to 200			$^{\circ}\text{C}$
Storage.	T_{stg}	-65 to 200			$^{\circ}\text{C}$
Lead- or Pin-Soldering					
Temperature ^a	T_L or T_p	230	230	230	$^{\circ}\text{C}$
(For 10 sec. max.)					



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DATA 1
5-65

40290, 40291, 40292

ELECTRICAL CHARACTERISTICS

Unless otherwise specified, electrode-voltage and electrode-current values for given test conditions are dc at case temperature = 25°C

		40290	40291	40292	
Collector-to-Emitter Breakdown Voltage					
I_C (Pulsed) = 200 mA ^b , $V_{BE} = -1.5V$,					
$R_{BE} = 39 \Omega$	BV_{CEX}	60	60	60	min V
$f \geq 100$, $V_{BE} = 0$,					
$I_C = 25$ mA	$BV_{CES(RF)}$	90	90	-	min V
$I_C = 50$ mA	$BV_{CES(RF)}$	-	-	90	min V
Emitter-to-Base Breakdown Voltage					
$I_B = 0.10$ mA, $I_C = 0$	BV_{EBO}	4	4	-	min V
$I_B = 0.25$ mA, $I_C = 0$	BV_{EBO}	-	-	4	min V
Collector-Cutoff Current					
$V_{CE} = 15$ V, $I_B = 0$	I_{CEO}	100	100	250	max μA
Real Part of Common-Emitter (Input Impedance)					
$f = 135$ Mc/s, $V_{CE} = 12.5$ V,					
$I_C = 100$ mA	$h_{ie}(\text{real})$	12	12	-	typ Ω
$I_C = 400$ mA	$h_{ie}(\text{real})$	-	-	6.5	typ Ω
Output Capacitance					
$f = 1$ Mc/s, $V_{CB} = 12.5$ V, $I_E = 0$	C_{ob}	17	17	30	max pF
Collector-to-Case Capacitance					
	C_S	-	6	6	max pF
Gain-Bandwidth Product					
$V_{CE} = 12.5$ V,					
$I_C = 100$ mA	f_T	500	500	-	typ Mc/s
$I_C = 400$ mA	f_T	-	-	300	typ Mc/s
RF Carrier Power Output^{c, d}					
$f = 135$ Mc/s, $V_{CE} = 12.5$ V,					
$P_i = 0.5$ W	P_o	2	2	-	min W
$P_i = 2$ W	P_o	-	-	6	min W
Thermal Resistance					
Junction-to-Case	θ_{JC}	25	15	7.5	max °C/W

^a Measured from seating plane (for 40290) or at distances $\geq 1/32$ " from insulating wafer (for 40291, 40292).

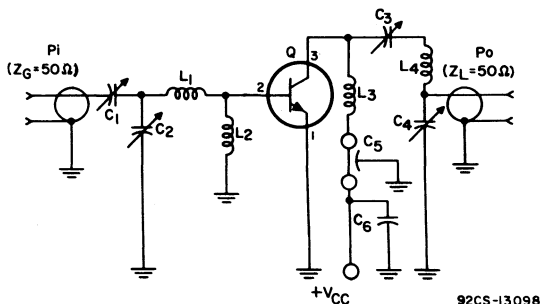
^b Pulsed through a 25 mH inductor; duty factor = 0.5.

^c Class-C Amplifier.

^d For conditions given, minimum efficiency = 70%.



RF AMPLIFIER CIRCUIT FOR POWER-OUTPUT TEST (135-Mc Operation)



Q = 40290, 40291

- $C_1, C_3 = 3-35 \text{ pF}$
- $C_2, C_4 = 8-60 \text{ pF}$
- $C_5 = 1000 \text{ pF}$
- $C_6 = 0.02 \mu\text{F}$
- $L_1 = 3 \text{ turns No. 16 wire, } 5/16'' \text{ ID, } 5/16'' \text{ long}$
- $L_2 = \text{Ferrite choke, } Z = 450 \Omega$
- $L_3 = 3 \text{ turns No. 18 wire, } 1/4'' \text{ ID, } 5/16'' \text{ long}$
- $L_4 = 5 \text{ turns No. 16 wire, } 7/16'' \text{ ID, } 5/8'' \text{ long}$

Q = 40292

- $C_1, C_3 = 3-35 \text{ pF}$
- $C_2, C_4 = 8-60 \text{ pF}$
- $C_5 = 1000 \text{ pF}$
- $C_6 = 0.02 \mu\text{F}$
- $L_1 = 3 \text{ turns No. 16 wire, } 5/16'' \text{ ID, } 5/16'' \text{ long}$
- $L_2 = \text{wire wound resistor, } R = 2.4 \Omega$
- $L_3 = 1 \text{ turn No. 16 wire, } 5/16'' \text{ ID, } 1/8'' \text{ long}$
- $L_4 = 4 \text{ turns No. 16 wire, } 7/16'' \text{ ID, } 3/8'' \text{ long}$



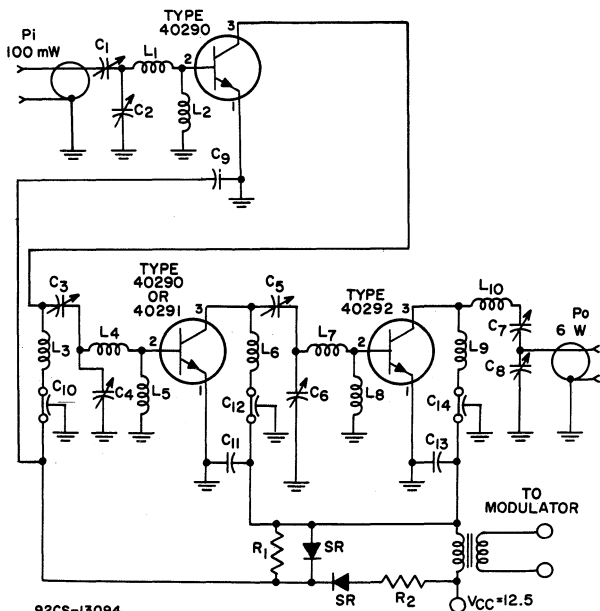
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DATA 2
5-65

40290, 40291, 40292

AMPLITUDE-MODULATED AMPLIFIER

135-Mc/s Operation, Carrier Power = 6 W minimum, Bandwidth = 5%



$C_1, C_3, C_5, C_7 = 3-35 \text{ pF}$

$C_2, C_4, C_6, C_8 = 8-60 \text{ pF}$

$C_9, C_{11}, C_{13} = 0.03 \text{ } \mu\text{F}$

$C_{10}, C_{12}, C_{14} = 1000 \text{ pF}$

$L_1, L_9 = 3 \text{ turns No. 16 wire, } 1/4'' \text{ ID, } 1/4'' \text{ long}$

$L_2, L_5 = \text{Ferrite choke, } Z = 450 \text{ } \Omega$

$L_3 = \text{RF choke, } 1.5 \text{ } \mu\text{H}$

$L_4, L_7 = 4 \text{ turns No. 16 wire, } 1/4'' \text{ ID, } 3/8'' \text{ long}$

$L_6 = \text{RF choke, } 1.0 \text{ } \mu\text{H}$

$L_8 = \text{wire wound resistor } R = 2.4 \text{ } \Omega$

$L_{10} = 5 \text{ turns No. 16 wire, } 3/8'' \text{ ID, } 1/2'' \text{ long}$

$R_1 = 220 \text{ } \Omega$

$R_2 = 180 \text{ } \Omega$

$\text{SR} = \text{IN2858}$



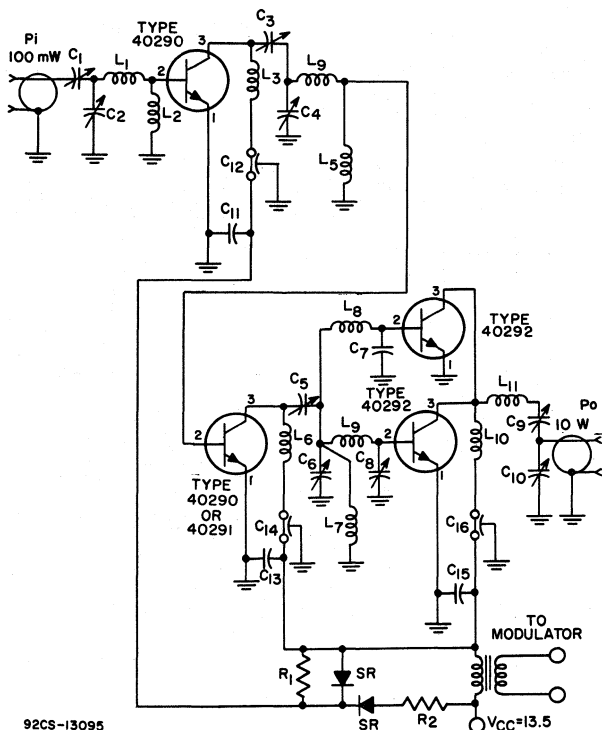
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DATA 3
5-65

40290, 40291, 40292

AMPLITUDE-MODULATED AMPLIFIER

135-Mc/s Operation, Carrier Power = 10 W minimum, Bandwidth = 5%



C1, C3, C5, C9 = 3-35 pF

C2, C4, C6, C10 = 8-60 pF

C7, C8 = 1.5-20 pF

C11, C13, C15 = 0.03 μ F

C12, C14, C16 = 1000 pF

L1 = 3 turns No. 16 wire, 1/4" ID, 1/4" long

L2, L5 = Ferrite choke, $Z = 450 \Omega$

L3 = RF choke, 1.5 μ H

L4 = 4 turns No. 16 wire, 1/4" ID, 3/8" long

L6, L7 = RF choke, 1.0 μ H

L8, L9 = 3 turns No. 16 wire, 1/4" ID, 3/8" long

L10 = 1 turn No. 16 wire, 5/16" ID, 1/8" long

L11 = 4 turns No. 16 wire, 3/8" ID, 1/2" long

R1 = 33 Ω

R2 = 36 Ω

SR = 1N2858



Transistor

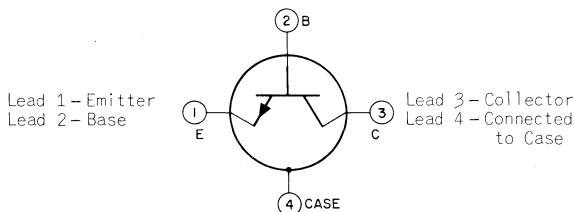
ULTRA-HIGH-RELIABILITY SILICON N-P-N EPITAXIAL-PLANAR TYPE

For UHF Low-Noise Amplifier, Mixer, and Oscillator Applications at Frequencies up to 500 Mc/s (Common-Emitter Configuration), and Up to 1200 Mc/s (Common-Base Configuration). Specially Controlled, Processed, and Tested for Critical Aerospace and Military Applications.

MECHANICAL

Dimensions. See Outline TO-72 in General Section

TERMINAL DIAGRAM (Bottom View)



ABSOLUTE-MAXIMUM RATINGS

Collector-to-Base Voltage	V _{CB0}	30	V
Collector-to-Emitter Voltage.	V _{CE0}	15	V
Emitter-to-Base Voltage	V _{EB0}	2.5	V
Collector Current	I _C	40	mA

Transistor Dissipation

For operation with heat sink:

At case temperatures:^a

Up to 25°C. P_T 300 mW

Above 25°C. Derate linearly 1.72 mW/°C

For operation in free air:

At free-air temperatures:

Up to 25°C. P_T 200 mW

Above 25°C. Derate linearly 1.14 mW/°C

Temperature Range

Operating range (Junction). T(opr) -65 to 200 °C

Storage range T(stg) -65 to 200 °C

Lead Soldering Temperature^b T_L 230 °C

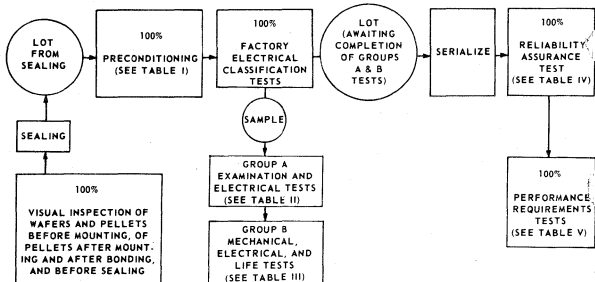
For 10 s max

^a Measured at center of seating surface.

^b Measured along lead at distances $\geq 1/32$ inch from seating surface.



HIGH-RELIABILITY TESTING PROCESS FLOW DIAGRAM



92CS-13700

TABLE I

100% PRECONDITIONING BEFORE FACTORY, QUALITY, RELIABILITY-
ASSURANCE AND PERFORMANCE REQUIREMENTS TESTS

Stabilization Bake 50 hours minimum at 200 °C
 5 complete cycles for -65 °C
 to +200 °C, each including
 Temperature Cycling { 15 minutes at -65 °C, 15
 Per Mil-Std-750 Ref. 1051, Cond.C } minutes at +200 °C, and
 5 minutes at 25 °C

Helium-Leak Test Leakage may not exceed 10^{-8} atm c³/s
 Per Mil-Std-202, Cond.C, Proc. III

Bubble Test 125 °C minimum, 1 minute,
 Per Mil-Std-202, Cond.A ethylene glycol

Plus

Sample Constant-Acceleration

(Centrifuge) Test 22,000 G's; Y₁ plane, 1 minute
 Per Mil-Std-750, Ref. 2006



TABLE II

Group A Tests ($T_{FA} = 25 \pm 30$ unless otherwise specified)

TEST METHOD ^c	TESTS PERFORMED & CHARACTERISTICS	LIMITS	
		Min	Max
Subgroup 1 — LTPD ^a -5			
207l	Visual and Mechanical Examination		
Subgroup 2 — LTPD-5			
3036 ^d	Collector-to-Base Cutoff Current $V_{CB} = 15 \text{ V}, I_E = 0$	I_{CBO}	- 10 nA
3041 ^e	Collector-to-Emitter Cutoff Current $V_{CE} = 16 \text{ V}$	I_{CES}	- 100 nA
3001 ^f	Collector-to-Base Breakdown Voltage $I_C = 0.001 \text{ mA}, I_E = 0$	BV_{CBO}	30 - V
3011 ^f	Collector-to-Emitter Breakdown Voltage $I_C = 3 \text{ mA (Pulse Test)}, I_B = 0$	$BV_{CEO}^{(sus)}$	15 - V
3026 ^f	Emitter-to-Base Breakdown Voltage $I_E = 0.01 \text{ mA}, I_C = 0$	BV_{EBO}	2.5 - V
3066 ^g	Base-to-Emitter Voltage. $I_C = 10 \text{ mA}, I_B = 1 \text{ mA}$	V_{BE}	- 1 V
3071	Collector-to-Emitter Voltage $I_C = 10 \text{ mA}, I_B = 1 \text{ mA}$	V_{CE}	- 0.4 V
3076	Static Forward Current-Transfer Ratio. $V_{CE} = 1 \text{ V}, I_C = 3 \text{ mA}$	h_{FE}	30 150
Subgroup 3 — LTPD-15			
3236	Open-Circuit Output Capacitance ^h $f \geq 0.1 \text{ Mc/s}, f \leq 1 \text{ Mc/s},$ $V_{CB} = 10 \text{ V}$	C_{obo}	- 1.8 pF
j	Small-Signal Power Gain ^k $f = 450 \text{ Mc/s}, V_{CE} = 6 \text{ V},$ $I_C = 1.5 \text{ mA}$	G_{pe}	12.5 19 dB
m	Device Noise Figure ^k $R_G = 50 \text{ ohms}, f = 450 \text{ Mc/s},$ $V_{CE} = 6 \text{ V}, I_C = 1.5 \text{ mA}$	NF	- 4.5 dB
n	Collector-to-Base Time Constant ^k $f = 31.9 \text{ Mc/s}, V_{CE} = 6 \text{ V},$ $I_E = -2 \text{ mA}$	$r_b' C_c$	4 15 ps
p	Oscillator Power Output. $f = 500 \text{ Mc/s}, V_{CB} = 10 \text{ V},$ $I_E = -12 \text{ mA}$	P_{oe}	30 - mW

Continued on next page.



TEST METHOD ^c	TEST PERFORMED & CHARACTERISTICS	LIMITS	
		Min	Max
Subgroup 4 — LTPD-10			
3076	Static Forward-Current Transfer Ratio (Low Temperature) $T_{FA} = -55 \pm 3^{\circ}\text{C}$, $V_{CE} = 1\text{ V}$, $I_C = 3\text{ mA}$	h_{FE}	10 -
3036 ^d	Collector-Cutoff Current (High Temperature) $T_{FA} = 150 \pm 0 - 5^{\circ}\text{C}$, $V_{CB} = 15\text{ V}$, $I_E = 0$	I_{CBO}	- 1 μA
Subgroup 5 — LTPD-10			
3206	Small-Signal Forward-Current Transfer Ratio ^k $f = 0.001\text{ Mc/s}$, $V_{CE} = 6\text{ V}$, $I_C = 2\text{ mA}$	h_{fe}	50 220
3206	Small-Signal Forward-Current Transfer Ratio ^k $f = 100\text{ Mc/s}$, $V_{CE} = 6\text{ V}$, $I_C = 5\text{ mA}$	$ h_{fe} $	10 19

^c Per Mil-Std-750.

^d Bias condition D.

^e Bias condition C.

^f Test condition D.

^g Test condition A.

^h Lead No. 4 (case) not connected.

^j See circuit, Neutralized Amplifier, 450-Mc/s.

^k Lead No. 4 (case) grounded.

^m See Block Diagram of Noise Figure Test Circuit.

ⁿ See Collector-to-Base Time Constant Measurement Circuit.

^p See Circuit, Oscillator, 500 Mc/s.

^q Lot tolerance per cent defective.

TABLE III

Group B Tests

TEST METHOD ^c	TESTS PERFORMED
<i>Subgroup 1 — LTPD-20</i>	
2066	Physical Dimensions (JEDEC TO-72 Pkg.)
<i>Subgroup 2 — LTPD-10</i>	
2031	Soldering Heat Test (1 cycle)
1051	Temperature-Cycling Test (Condition C)
1056 ^g	Thermal-Shock Test ($T_{min} = 0 + 5, - 0^{\circ}\text{C}$; $T_{max} = 100 + 0, - 5^{\circ}\text{C}$)
1021	Moisture-Resistance Test

Continued on next page.



TEST
METHOD^c

TESTS PERFORMED

Subgroup 3 — LTPD-10

- 2016 Shock Test: Non-Operating (1500 G's; 0.5 ms; 5 blows each in X₁, Y₁, Y₂, and Z₁ planes)
 2046 Vibration Fatigue Test: Non-Operating (60 ± 20 c/s; 20 G's)
 2056 Variable-Frequency Vibration Test
 2006 Constant-Acceleration Test (20,000 G's)

Subgroup 4 — LTPD-20

- 2036^r Terminal Strength Test

Subgroup 5 — LTPD-20

- 1041 Salt-Atmosphere Test

Subgroup 6 — $\lambda = 10\%$

- 1031 High-Temperature Life Test: Non-Operating ($T_{FA} \pm 200 \pm 10$ °C; Duration = 1000 hours)

Subgroup 7 — $\lambda = 10\%$

- 1026 Steady-State Operation Life Test (Common-Base Circuit; $T_{FA} = 25 \pm 3$ °C; $V_{CB} = 19.5 \pm 0.5$ V; $P_T = 200$ mW; Duration = 1000 hours)

CHARACTERISTICS

Initial and Endpoint Values for Test Performed in Table III
Under Subgroup 2 through 7

		INITIAL		END POINT	
		Min	Max	Min	Max
Subgroup 2, 3, & 5					
3036D	Collector-Cutoff Current I_{CBO} - 10 $T_{FA} = 25 \pm 3^{\circ}\text{C}$, $V_{CB} = 15\text{ V}$	-	10	-	12 nA
3076	Static Forward-Current Transfer Ratio. h_{FE} 30 150 $T_{FA} = 25 \pm 3^{\circ}\text{C}$, $V_{CE} = 1\text{ V}$, $I_C = 3\text{ mA}$	30	150	27	-
Subgroup 4					
-	Helium Leak Test (atm); Bubble Test Mil-Std 202, Condition C, Procedure III Mil-Std 202, Condition A; $T_A = 125^{\circ}\text{C min}$; 1 minute	-	-	-	$10^{-8}\text{ cm}^3/\text{s}$
Subgroups 6, 7					
3036D	Collector-Cutoff Current I_{CBO} - 10 $T_{FA} = 25 \pm 3^{\circ}\text{C}$, $V_{CB} = 15\text{ V}$	-	10	-	20 nA

^r Test Condition E.

Continued on next page.



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CHARACTERISTICS (Continued)

TEST METHOD ^C		INITIAL		END POINT		
		Min	Max	Min	Max	
	Subgroups 6, 7					
3076	Static Forward-Current Transfer Ratio. h_{FE}	30	150	24	-	
	$T_{FA} = 25 \pm 3^{\circ}\text{C}$, $V_{CE} = 1\text{ V}$, $I_C = 3\text{ mA}$					

TABLE IV

100% Reliability Assurance Test

TEST METHOD ^c	TEST PERFORMED
1026	Power Burn-In: Common-Base Circuit $T_{FA} = 25 \pm 3^{\circ}$, $V_{CB} = 12.5 \pm 0.5\text{ V}$, $P_T = 200\text{ mW}$, Duration = 340 hours

CHARACTERISTICS

Initial and Endpoint Values for Test Performed in Table IV

		INITIAL Min Max	END POINT	
			Min	Max
3036 ^d	Collector-Cutoff Current ΔI_{CB0}	10 max	$\Delta = \pm 10\text{ nA}$	
	$T_{FA} = 25 \pm 3^{\circ}\text{C}$, $V_{CB} = 15\text{ V}$			
3076	Static Forward-Current Transfer Ratio. Δf_{FE}	30 min	$\Delta = \pm 10\%$	
	$T_{FA} = 25 \pm 3^{\circ}\text{C}$, $V_{CE} = 1\text{ V}$, $I_C = 3\text{ mA}$			

TABLE V

100% Performance Requirements Tests $(T_{FA} = 25 \pm 3^{\circ}\text{C})$

CHARACTERISTICS

TEST METHOD ^c			LIMITS	
			Min	Max
3036 ^d	Collector-Cutoff Current I_{CB0}		-	10 nA
	$V_{CB} = 15\text{ V}$, $I_E = 0$			
3041 ^e	Collector-Cutoff Current I_{CES}		-	100 nA
	$V_{CE} = 16\text{ V}$			
3001 ^f	Collector-to-Base Breakdown Voltage BV_{CB0}		30	- V
	$I_C = 0.001\text{ mA}$, $I_E = 0$			
3011 ^f	Collector-to-Emitter Breakdown Voltage $BV_{CEO}(\text{sus})$		15	- V
	$I_C = 3\text{ mA}$ (Pulse Test), $I_B = 0$			

Continued on next page.



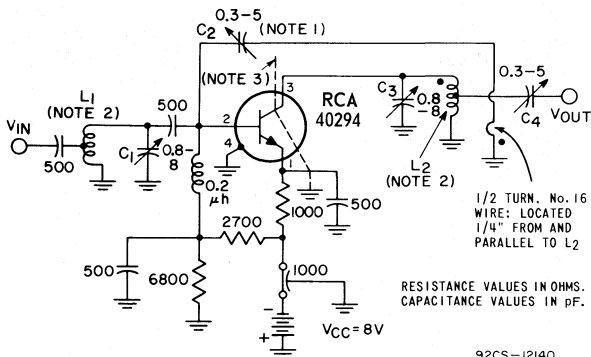
CHARACTERISTICS (Continued)

TEST METHOD ^c			LIMITS	
			Min	Max
3026 ^f	Emitter-to-Base Breakdown Voltage	BV_{EBO}	2.5	- V
	$I_E = 0.01 \text{ mA}, I_C = 0$			
3066 ^g	Base-to-Emitter Voltage. . . .	V_{BE}	-	1 V
	$I_C = 10 \text{ mA}, I_B = 1 \text{ mA}$			
3071	Collector-to-Emitter Voltage .	V_{CE}	-	0.4 V
	$I_C = 10 \text{ mA}, I_B = 1 \text{ mA}$			
3076	Static Forward Current Transfer Ratio.	h_{FE}	30	150
	$V_{CE} = 1 \text{ V}, I_C = 3 \text{ mA}$			
m	Device Noise Figure ^k	NF	-	4.5 dB
	$R_G = 50 \text{ ohms}$			

For visual examination (external) under 20-power magnification, examine for plating, branding, and lead fatigue.



POWER-OUTPUT MEASUREMENT CIRCUIT
Neutralized Amplifier, 450 Mc/s



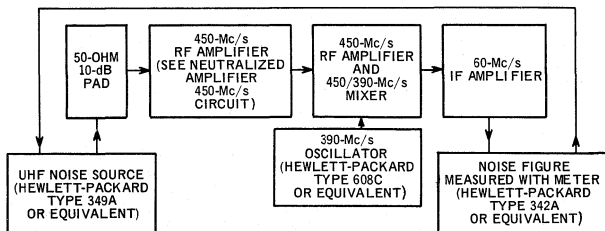
92CS-12140

Note 1: (Neutralization Procedure): (A) Connect a 450-Mc/s signal generator (with $Z_{out} = 50$ ohms) to the input terminals of the amplifier. (B) Connect a 50-ohm RF voltmeter across the output terminals of the amplifier. (C) Apply V_{CC} , and with the signal generator adjusted for 10 mV output, tune C_1 , C_3 , and C_4 for maximum output. (D) Interchange the connections to the signal generator and the output indicator. (E) With sufficient signal applied to the output terminals of the amplifier, adjust C_2 for a minimum indication at the input. (F) Repeat steps (A), (B), and (C) to determine if retuning is necessary.

Note 2: L₁ & L₂ — Silver-plated brass rod, 1-1/2" long x 1/4" dia. Install at least 1/2" from nearest vertical chassis surface. Tap 1-1/4" from chassis end.

Note 3: External interlead shield to isolate the output circuit from the input circuit.

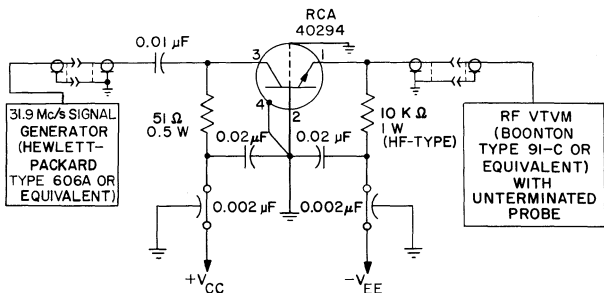
BLOCK DIAGRAM OF NOISE-FIGURE TEST CIRCUIT



92CS-13699



COLLECTOR-TO-BASE TIME CONSTANT MEASUREMENT CIRCUIT

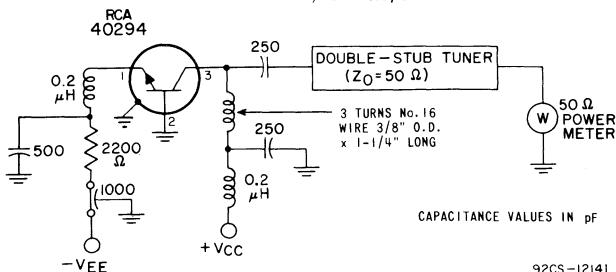


92CS-13698

Note: Careful shielding must be used between input and output to keep signal feed-through to an absolute minimum.

POWER-OUTPUT MEASUREMENT CIRCUIT

Oscillator, 500 Mc/s



CAPACITANCE VALUES IN pF

92CS-12141

PROCEDURE:

1. Adjust V_{CC} and V_{EE} for $V_{CB} = 6$ volts, $I_E = 2$ mA.
2. Connect a short piece of wire between the collector and emitter leads.
3. Adjust 31.9 Mc/s input for 0.5 volt rms reading on VTVM.
4. Remove the connection between collector and emitter and read $r_b'C_c$ on RF voltmeter scale ($r_b'C_c$ in picoseconds = 10 times meter indication in millivolts) (1 millivolt = 10 picoseconds).

All Characteristic Curves shown under type 2N2857 also apply to the 40294



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40305, 40306, 40307

Transistors

SILICON N-P-N "OVERLAY" EPITAXIAL-PLANAR TYPES

For High-Reliability, Large-Signal, High-Power, VHF-UHF Applications in Space, Industrial, and Military Communications Equipment for Class-A, -B, or -C Amplifier, Frequency Multiplier, or Oscillator Operation

Dimensions

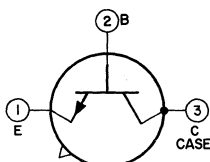
40305. See Outline TO-39 in General Section

40306, 40307 See Outline TO-60 in General Section

Terminal Diagrams

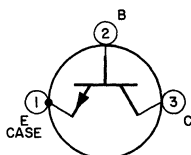
BOTTOM VIEWS

40305



Lead 1—Emitter
Lead 2—Base
Lead 3—Collector, Case

40306, 40307



Pin 1—Emitter, Case
Pin 2—Base
Pin 3—Collector

RADIO-FREQUENCY SERVICE

Maximum Ratings, Absolute-Maximum Values

	40305	40306	40307	
Collector-to-Base Voltage . . . V_{CB0}	65	65	65	V
Collector-to-Emitter Voltage				
$V_{BE} = -1.5$ V. V_{CEV}	65	65	65	V
Base open V_{CEO}	40	40	40	V
Emitter-to-Base Voltage V_{EB0}	4	4	4	V
Collector Current I_C	1	1.5	3	A

Transistor Dissipation

At case temperatures:

From -65° to 25° C. P_T 7 11.6 23 W

Above 25° C. Derate linearly to 0 W at 200° C

Temperature Range

Operating (Junction). T_{opr} -65 to 200 $^{\circ}$ C

Storage T_{stg} -65 to 200 $^{\circ}$ C

Lead- or Pin-Soldering

Temperature^a T_L or T_p 230 230 230 $^{\circ}$ C

(For 10 sec. max.)



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DATA 1
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40305, 40306, 40307

ELECTRICAL CHARACTERISTICS

Unless otherwise specified, electrode-voltage and electrode-current values for given test conditions are dc at case temperature = 25° C.

40305 40306 40307

Collector-to-Base Breakdown Voltage

$I_C = 0.1 \text{ mA}, I_E = 0$	BV_{CBO}	-	65	-	min	V
$I_C = 0.3 \text{ mA}, I_E = 0$	BV_{CBO}	65	-	-	min	V
$I_C = 0.5 \text{ mA}, I_E = 0$	BV_{CBO}	-	-	65	min	V

Collector-to-Emitter Breakdown Voltage

I_C (Pulsed) = 0 to 200 mA ^b , $V_{BE} = -1.5$	BV_{CEX}	65 ^c	65 ^c	65 ^c	min	V
I_C (Pulsed) = 0 to 200 mA ^b , $I_B = 0$	BV_{CEO}	40 ^c	40 ^c	40 ^c	min	V

Emitter-to-Base Breakdown Voltage

$I_E = 0.1 \text{ mA}, I_C = 0$	BV_{EBO}	4	4	-	min	V
$I_E = 0.25 \text{ mA}, I_C = 0$	BV_{EBO}	-	-	4	min	V

Collector-to-Emitter Saturation Voltage

$I_C = 0.5 \text{ A}, I_B = 100 \text{ mA}$.	$V_{CE(sat)}$	-	1	1	max	V
$I_C = 250 \text{ mA}, I_B = 50 \text{ mA}$.	$V_{CE(sat)}$	1	-	-	max	V

Collector Cutoff Current

$V_{CE} = 30 \text{ V}, I_B = 0$	I_{CEO}	0.1	0.1	0.25	max	μA
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DC Forward-Current

Transfer Ratio

$V_{CE} = 5 \text{ V}, I_C = 150 \text{ mA}$.	h_{FE}	10	10	-	min	
$V_{CE} = 5 \text{ V}, I_C = 200 \text{ mA}$.	h_{FE}	-	-	10	min	

Output Capacitance

$f = 1 \text{ Mc/s}, V_{CB} = 30 \text{ V}, I_E = 0$	C_{ob}	10	10	20	max	pF
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RF Power Output Amplifier, Unneutralized^d

$V_{CE} = 28 \text{ V},$ $f = 100 \text{ Mc/s}, P_i = 1 \text{ W}.$	P_o	-	7.5 ^e	-	min	W
$f = 175 \text{ Mc/s}, P_i = 0.25 \text{ W}$	P_o	2.5 ^f	-	-	min	W
$f = 175 \text{ Mc/s}, P_i = 3.5 \text{ W}.$	P_o	-	-	13.5 ^g	min	W
$f = 400 \text{ Mc/s}, P_i = 1 \text{ W}.$	P_o	-	3 ^h	-	min	W

^a Measured at distances $\geq 1/32$ inch from seating plane (for 40305) and from insulating wafer (for 40306, 40307).

^b Pulsed through a 25 mH inductor; duty factor = 0.5.

^c Measured at a current where the breakdown voltage is a minimum.

^d See accompanying *Power-Output-Measurement Circuits*.

^e For conditions given, minimum efficiency = 65 per cent.

^f For conditions given, minimum efficiency = 50 per cent.

^g For conditions given, minimum efficiency = 70 per cent.

^h For conditions given, minimum efficiency = 40 per cent.



40305, 40306, 40307

All Characteristics Curves
shown under types 2N3553, 2N3375, and 2N3632
also apply to the 40305, 40306, and 40307 respectively

RELIABILITY TESTING

Preconditioning (100 Per Cent Testing of Each Transistor)

1. Helium Leak, 1×10^{-8} cc/sec. max.
2. Temperature Cycling—Method 102A of MIL-STD-202, 3 cycles, -65°C $+200^{\circ}\text{C}$
3. Methanol Bomb, 70 psig, 16 hours minimum
4. Bake, 72 hours minimum, $+200^{\circ}\text{C}$
5. Constant Acceleration—Method 2006 of MIL-STD-750, 10,000g Y_1 axis
6. Serialization
7. j Record I_{CEO} , h_{FE} , $V_{CE}(\text{sat})$
8. Power Age $T_{FA} = 25^{\circ}\text{C}$, $V_{CB} = 28\text{ V}$, $t = 168$ hours,
 P_T (40305) = 1 W, P_T (40306, 40307) = 2.6 W, free air
9. j Record I_{CEO} , h_{FE} , $V_{CE}(\text{sat})$
10. X-Ray Inspection RCA Spec. 1750326
11. Record Subgroups 2 and 3 of Group A Tests

j Delta criteria after 168 hours Power Age

I_{CEO} $\begin{cases} 40305 \\ 40306 \end{cases} +100\%$ or +10 nanoamperes whichever is greater
 I_{CEO} 40307 +100% or +25 nanoamperes whichever is greater
 h_{FE} +30%
 $V_{CE}(\text{sat})$ +0.1 V

Group A Tests

TEST METHOD ^k	EXAMINATION OR TEST & CONDITIONS	LIMITS			
		40305	40306	40307	
	SUBGROUP 1 — LTPD-10				
2071	Visual and Mechanical Examination				
	SUBGROUP 2 — LTPD-5				
3041D	Collector-to-Emitter Cutoff Current. . . I_{CEO}	0.1	0.1	0.25	max μA
	$V_{CE} = 30\text{ V}$, $I_B = 0$				
3001D	Collector-to-Base Breakdown Voltage				
	$I_C = 300\text{ }\mu\text{a}$, $I_E = 0$. BV_{CBO}	65			min V
	$I_C = 100\text{ }\mu\text{a}$, $I_E = 0$. BV_{CBO}		65		min V
	$I_C = 500\text{ }\mu\text{a}$, $I_E = 0$. BV_{CBO}			65	min V
3026D	Emitter-to-Base Breakdown Voltage				
	$I_E = 100\text{ }\mu\text{a}$, $I_C = 0$. BV_{EBO}	4	4	-	min V
	$I_E = 250\text{ }\mu\text{a}$, $I_C = 0$. BV_{EBO}	-	-	4	min V

Continued on next page.



40305, 40306, 40307

TEST METHOD ^k	EXAMINATION OR TEST & CONDITIONS	LIMITS			
		40305	40306	40307	
SUBGROUP 2 — LTPD-5					
3011D	Collector-to-Emitter Breakdown Voltage . BV_{CEO} $I_C = 0$ to 200 mA, ^b $I_B = 0$	40°	40°	40° min	V
3011A	Collector-to-Emitter Breakdown Voltage . BV_{CEX} $I_C = 0$ to 200 mA, ^b $V_{BE} = -1.5$ V	65°	65°	65° min	V
3071	Collector-to-Emitter Saturation Voltage $I_C = 250$ mA, $I_B = 50$ mA $V_{CE(sat)}$ $I_C = 500$ mA, $I_B = 100$ mA $V_{CE(sat)}$	1 - - 1	- 1	- 1	max

Continued on next page.



3076 Forward Current Transfer Ratio

$$T_{FA} = 150^{\circ}C \pm 3^{\circ}C,$$

$$I_C = 150 \text{ mA},$$

$$V_{CE} = 5 \text{ V} \dots h_{FE} \quad 200 \quad 200 \quad - \quad \text{max}$$

$$I_C = 300 \text{ mA},$$

$$V_{CE} = 5 \text{ V} \dots h_{FE} \quad - \quad - \quad 200 \quad \text{max}$$

k Per Mil-Std-750.

m See circuit, Unneutralized RF Amplifier, 175 Mc/s (40305).

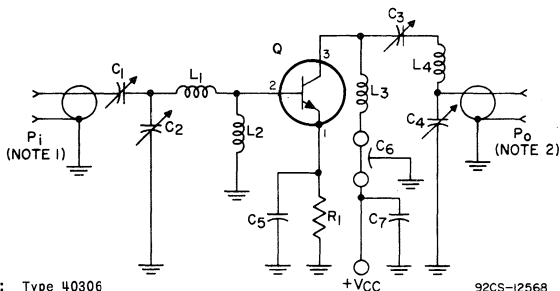
n See circuit, Unneutralized RF Amplifier, 100 Mc/s (40306).

p See circuit, Unneutralized RF Amplifier, 175 Mc/s (40307).

q See circuit, Unneutralized RF Amplifier, 400 Mc/s (40306).

POWER-OUTPUT MEASUREMENT CIRCUITS

Unneutralized RF Amplifier, 100 Mc/s (40306)



Q: Type 40306

92CS-12568

Note 1: Generator Impedance = 50 Ω .

Note 2: Load Impedance = 50 Ω .

C1, C2: 7-100 pF

L1: 3 turns No. 16 wire, 1/4" ID, 5/16" long

C3, C4: 4-40 pF

L2: Ferrite choke, Z = 750 ($\pm 20\%$) Ω

C5: 330 pF, disc ceramic

L3: 2.4- μ H choke

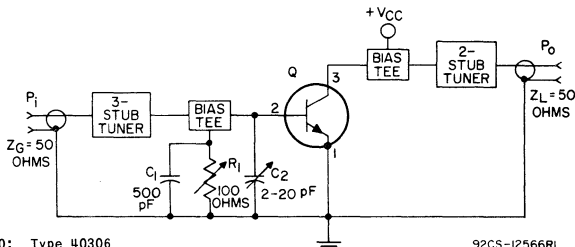
C6: 1500 pF

L4: 5 turns No. 16 wire, 5/16" ID, 7/16" long

C7: 0.005 μ F, disc ceramic

R1: 1.35 Ω , non-inductive

Unneutralized RF Amplifier, 400 Mc/s (40306)



Q: Type 40306

92CS-12566R1



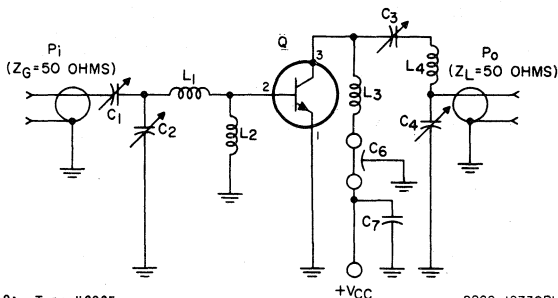
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POWER-OUTPUT MEASUREMENT CIRCUITS

Unneutralized RF Amplifier, 175 Mc/s (40305)



Q: Type 40305

92CS-12739R1

C1, C2, C3, C4: 3-35 pF

C6: 1000 pF

C7: 0.005 μ F, disc ceramic

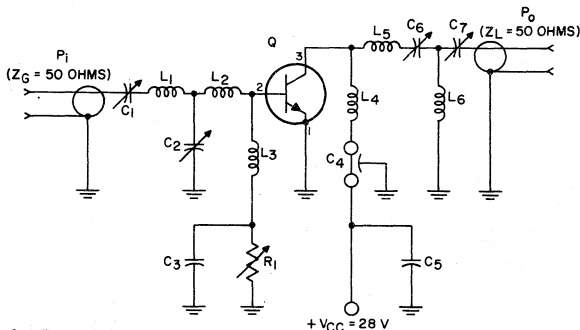
L1: 2 turns No.16 wire, 3/16" ID, 1/4" long

L2: Ferrite choke, Z = 450 Ω

L3: 2 turns No.16 wire, 1/4" ID, 1/4" long

L4: 4 turns No.16 wire, 3/8" ID, 3/8" long

Unneutralized RF Amplifier, 175 Mc/s (40307)



Q: Type 40307

92CS-13120

C1, C6: 3-35 pF

C2, C7: 8-60 pF

C4: 1000 pF

C3, C5: 0.005 μ F, disc ceramic

L1, L5: 4 turns No.18 wire, 1/4" ID, 3/16" long

L2: 1 turn No.16 wire, 1/4" ID, 3/16" long

L3: Ferrite choke, Z = 450 Ω

L4: RF choke, 1.0 μ H

L6: 2-1/2 turns No.16 wire, 1/4" ID, 1/4" long

R1: 50 Ω



Power Transistors

40319 — P-N-P SILICON TYPE

All Other Types — N-P-N SILICON TYPES

For Audio Amplifier Applications Requiring High Quality Performance at Power Outputs to 50 Watts.

Dissipations (P_T) Range from 5 to 117 Watts at $T_C = 25^\circ C$.

Dimensions

40309, 40311, 40314, 40315, } Low Power Types
40317, 40319, 40320, 40321, } See Outline TO-5 in General Section ←
40323, 40326, 40327

40310, 40312, 40313, 40316, } Intermediate Power Types
40318, 40322, 40324, 40328 } See Outline TO-66 in General Section

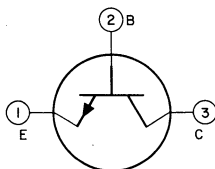
40325 } High Power Type
} See Outline TO-3 in General Section

Terminal Diagrams

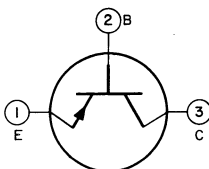
BOTTOM VIEW

40309 40311 40314
40315 40317 40320
40321 40323 40326
40327

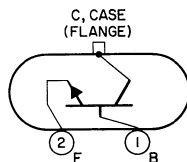
40310 40312 40313
40316 40318 40322
40324 40325 40328



Lead 1—Emitter
Lead 2—Base
Lead 3—Collector



Lead 1—Emitter
Lead 2—Base
Lead 3—Collector



Pin 1—Base
Pin 2—Emitter
Mounting Flange—
Collector, Case

For Definitions of Symbols, see accompanying *Symbols and Terms*.

← Indicates a change.



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DATA 1
12-65

ABSOLUTE-MAXIMUM RATINGS

RCA Type	$V_{CE0(sus)}$ V	$V_{CER(sus)}$ V	V_{EB0} V	I_C A	I_B A	P_T^d	
						$T_C =$	$T_{FA} =$
						-65—25°C W	-65—25°C W
40309	18		2.5	0.7	0.2	5	1
40310	35		2.5	4	2	29	-
40311	30		2.5	0.7	0.2	5	1
40312		60 ^a	2.5	4	2	29	-
40313		300 ^a	2.5	2	1	35	-
40314	40		2.5	0.7	0.2	5	1
40315	35		2.5	0.7	0.2	5	1
40316		40 ^a	5	4	2	29	-
40317	40		2.5	0.7	0.2	5	1
40318		300 ^a	6	2	1	35	-
40319	-40		-2.5	-0.7	-0.2	5	1
40320	40		2.5	0.7	0.2	5	1
40321		300 ^b	5	1	0.5	5 ^e	1 ^f
40322		300 ^a	6	2	1	35	-
40323	18		2.5	0.7	0.2	5	1
40324	35		2.5	4	2	29	-
40325	35 ^c		5	15	7	117	-
40326	40		2.5	0.7	0.2	5	1
40327		300 ^b	5	1	0.5	5 ^e	1 ^f
40328		300 ^a	6	2	1	35	-

Temperature Range (For all types)

Operating (Junction) T_{opr} -65 to 200° C

FOOTNOTES FOR ABSOLUTE MAXIMUM RATINGS

^a RBE = 500 ohms.^b RBE = 1000 ohms.^c This value also applies to the Absolute Maximum Ratings of the Collector-to-Emitter Voltage (V_{CEV}) whose bias voltage is $V_{BE} = -1.5$ volts and to the Collector-to-Base Voltage (V_{CBO}).^d For temperatures above 25° C (Types 40321, 40327 above 50° C) see accompanying *Dissipation Derating Charts*.^e At case temperatures up to 50° C.^f At free-air temperatures up to 50° C.For Definitions of Symbols, see accompanying *Symbols and Terms*.

ELECTRICAL CHARACTERISTICS

Unless otherwise specified, electrode voltage and electrode-current values for given test conditions are dc at case temperature = 25° C

Low-Power Types

Low-Voltage Driver Types

Test Conditions									
V _{CB}	15 V			4 V		4 V			10 V
V _{CE}		2.5 V							
V _{EB}									
I _C			100 mA ^a	50 mA	150 mA	50 mA			50 mA
I _B					15 mA				
Characteristics									
RCA Type	I _{CB0} max μA	I _{EB0} max mA	V _{CE0} (sus) min V	V _{BE} max V	V _{CE} (sat) max V	h _{FE} min max	θ _{JC} max °C/W	θ _{JFA} max °C/W	f _T typ Mc/s
40309	0.25 1 mA ^b	1	18 ^c	1	-	70 350	35	175	100
40311	0.25 1 mA ^b	1	30	1	-	70 350	35	175	100
40314	0.25 1 mA ^b	1	40	1	1.4	70 350	35	175	100 ^d
40315	0.25 1 mA ^b	1	35 ^c	1	-	70 350	35	175	100
40317	0.25 1 mA ^b	1	40	1 ^e	-	40 ^e 200 ^e	35	175	-
40319 ^f	-0.25 -1 mA ^b	-1	-40	-1	-1.4	35 200	35	175	100
40320	0.25 1 mA ^b	1	40	1 ^e	-	40 ^e 200 ^e	35	-	-
40323	0.25 1 mA ^b	1	18 ^c	1	-	70 350	35	175	100
40326	0.25 1 mA ^b	1	40	1 ^e	-	40 ^e 200 ^e	30	-	-

FOOTNOTES FOR LOW-POWER TYPES

^a Pulse duration = 300 μs, duty factor ≤ 0.02.

^b At T_C = 150° C.

^c BV_{CE0} value.

^d At V_{CE} = 4 V, I_C = 50 mA.

^e At V_{CE} = 4 V, I_C = 10 mA.

^f Values for test conditions shown above are the same but have negative signs.

^g R_{BE} = 1000 ohms.

For Definitions of Symbols, see accompanying Symbols and Terms.

← Indicates a change.



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DATA 2
12-65

40309 to 40328

High-Voltage Driver Types

Test Conditions							
V_{CB}	150 V						
V_{CE}		150 V		10 V		10 V	
V_{EB}			5 V				
I_C				50 mA	50 mA	20 mA	
T_C	150° C						
Characteristics							
RCA Type	I_{CBO} max μA	I_{CER}^g max μA	I_{EBO} max μA	V_{BE} max V	$V_{CER(sus)}^g$ min V	h_{FE} min max	θ_{JC} max °C/W
40321	100	5	100	2	300	25 200	30
40327	100	5	100	2	300	40 250	30

Intermediate-Power Types

Test Conditions										
V_{CB}	15 V									
V_{CE}		300 V		2 V		2 V	4 V	150 V		
V_{EB}		1.5 V	2.5 V						4 V	
I_C				1 A	200 mA	1 A	500 mA			
Characteristics										
RCA Type	I_{CBO} max mA	I_{CEV} max mA	I_{EBO} max mA	V_{BE} max V	$V_{CER(sus)}$ min V	h_{FE} min max	f_T typ kc/s	I_s/b min mA	E_s/b min μJ	θ_{JC} max °C/W
40310	0.01 5 ^c	-	5	1.4	35 ^b	20 120	750	-	-	6
40312	0.01 5 ^c	-	5	1.4	60 ^d	20 120	750	-	-	6
40313	5 ^e	10 10 ^c	5	1.5 ^f	300 ^g	40 ^f or h 250 ^f	-	150	-	5
40316	0.01 5 ^c	-	5 ^j	1.4	40 ^d	20 120	750	-	-	6
40318	5 ^e	5 ^a 10 ⁿ	5 ^k	1.5 ^h	300 ^g	40 ^m 50 ^h	-	100	50	5
40322	5 ^e	10 ^a 10 ⁿ	5 ^k	-	300 ^p	40 ^m 75 ^h	-	100	50	5
40324	0.01 5 ^c	-	5	1.4	35 ^b	20 120	750	-	-	6
40328	5 ^e	10 ^a 10 ⁿ	5 ^k	1.5 ^q	300 ^g	20 ^q 40 ^m	-	100	-	5

For Definitions of Symbols, see accompanying *Symbols and Terms*.

→ Indicates a change.



FOOTNOTES FOR INTERMEDIATE-POWER TYPES

- a At $V_{CE} = 150$ V, $V_{EB} = 1.5$ V.
 b BV_{CEO} value at $I_C = 100$ mA. Pulse duration = 300 μ s; duty factor ≤ 0.02 .
 c At $T_C = 150^\circ$ C.
 d At $I_C = 100$ mA, $R_{BE} = 500$ ohms.
 e I_{CEO} value at $V_{CE} = 150$ V. (V_{CB} value does not apply).
 f At $V_{CE} = 10$ V, $I_C = 0.1$ A.
 g $R_{BE} = 500$ ohms.
 h $V_{CE} = 10$ V, $I_C = 0.5$ A.
 j At $V_{EB} = 5$ V.
 k At $V_{EB} = 6$ V.
 m At $V_{CE} = 10$ V, $I_C = 20$ mA.
 n At $V_{CE} = 150$ V, $V_{EB} = 1.5$ V, $T_C = 150^\circ$ C.
 p $R_{BE} = 200$ ohms, $L = 5$ mH.
 q At $V_{CE} = 10$ V, $I_C = 1$ A.

High Power Type

Test Conditions								
V_{CB}	30 V							
V_{CE}					4 V		4 V	
V_{EB}		5 V						
I_B						0.8 A		
I_C			200 mA	100 mA	8 A	8 A	8 A	
Characteristics								
RCA Type	I_{CB0} max mA	I_{EB0} max mA	$BV_{CEO}(\text{sus})$ min V	BV_{CB0} min V	V_{BE} max V	$V_{CE}(\text{sat})$ max V	h_{FE} min max	θ_{JC} max $^\circ\text{C/W}$
40325	5 10 ^a	10	35	35	2	1.5	12 60	1.5

FOOTNOTE FOR HIGH-POWER TYPE

- a At $T_C = 150^\circ$ C.

For Definitions of Symbols, see accompanying *Symbols and Terms*.



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DATA 3
10-65

SYMBOLS AND TERMS

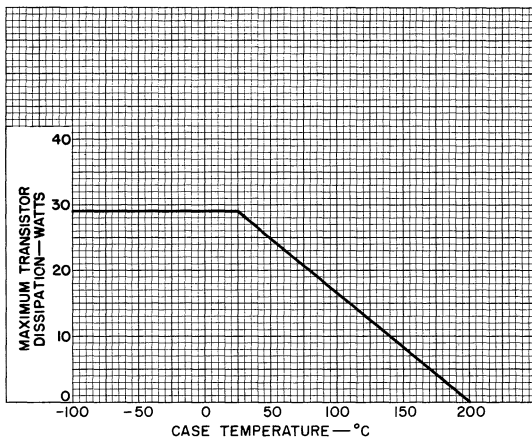
Listed alphabetically below are the transistor symbols with their associated terms.

BV_{CEO}	DC collector-to-emitter breakdown voltage, base open
BV_{CER}	DC collector-to-emitter breakdown voltage with specified external base-to-emitter resistance (R_{BE})
$E_{S/b}$	Second breakdown energy at which second breakdown occurs under specified reverse bias conditions
f_T	Gain-bandwidth product
h_{FE}	DC forward-current transfer ratio (common-emitter circuit)
I_B	DC base current
I_C	DC collector current
I_{CBO}	DC collector-cutoff current, emitter open
I_{CEO}	DC collector-cutoff current, base open
I_{CEV}	DC collector-cutoff current with a specified voltage between base and emitter terminals
I_{EBO}	DC emitter-cutoff current, collector open
$I_{S/B}$	Collector current at which second breakdown occurs at a specified collector-to-emitter voltage
P_T	Transistor dissipation
V_{BE}	DC base-to-emitter voltage
$V_{CEO(sus)}$	DC collector-to-emitter sustaining voltage, base open
$V_{CER(sus)}$	DC collector-to-emitter sustaining voltage with specified external base-to-emitter resistance (R_{BE})
V_{EBO}	DC emitter-to-base voltage, collector open
θ_{JC}	Thermal resistance, junction-to-case
θ_{JFA}	Thermal resistance, junction-to-free-air



Dissipation Derating Curve

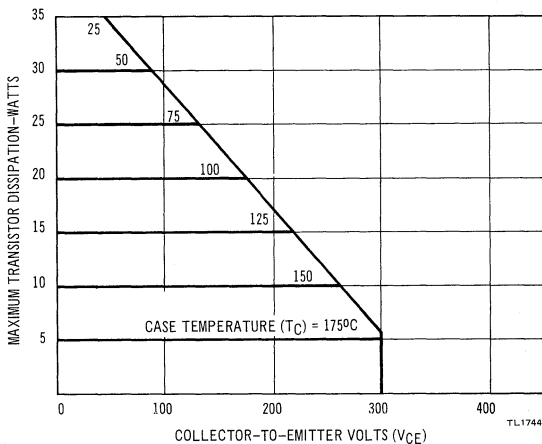
40310 40312 40316 40324



92CS-13005

Dissipation Derating Curve

40313



TL1744C



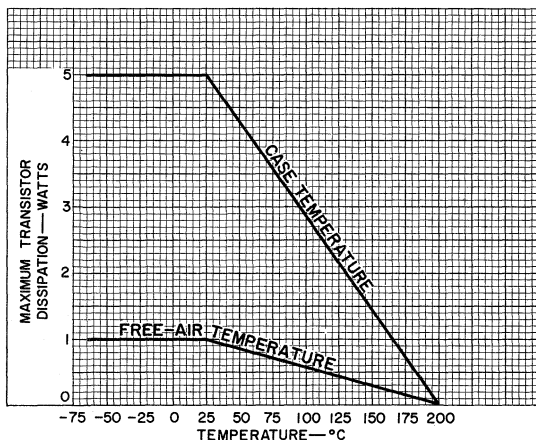
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DATA 4
10-65

40309 to 40328

Dissipation Derating Curve

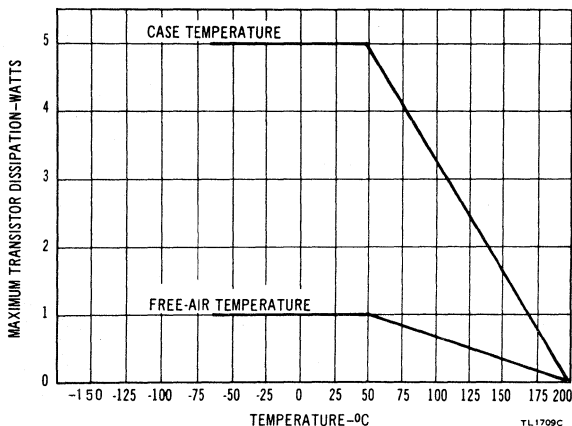
40309 40311 40314 40315
40317 40319 40320 40323 40326



92CS-III72RI

Dissipation Derating Curve

40321 40327

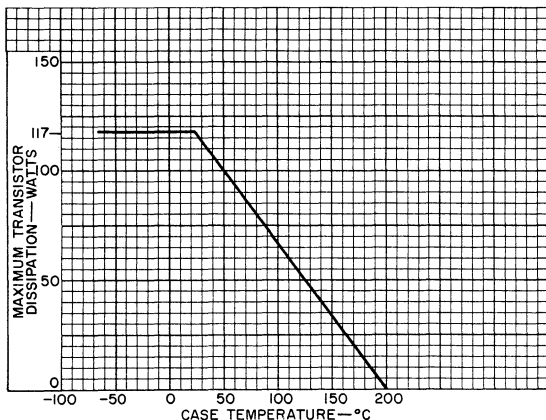


TL1709C



Dissipation Derating Curve

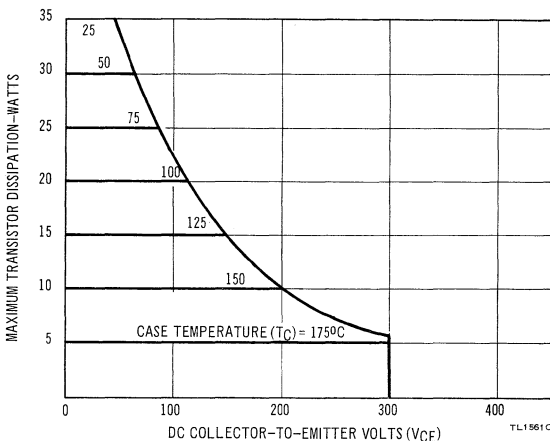
40325



92CS-13031

Dissipation Derating Curve

40318 40322 40328



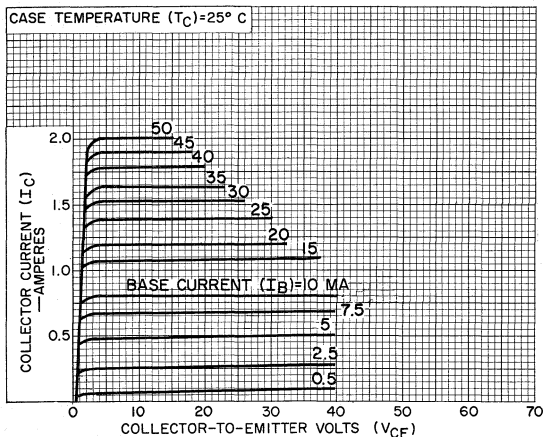
TL1561C



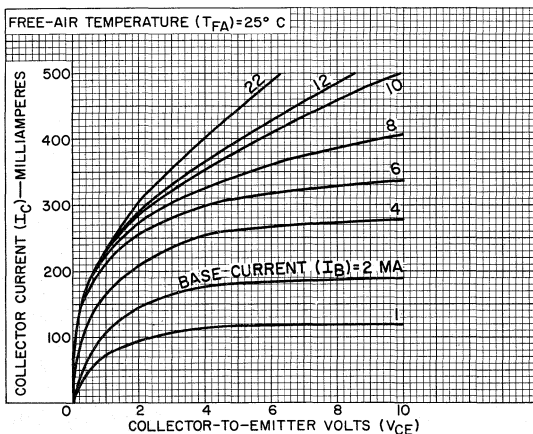
40309 to 40328

Typical Collector Characteristics

40310 40316 40324



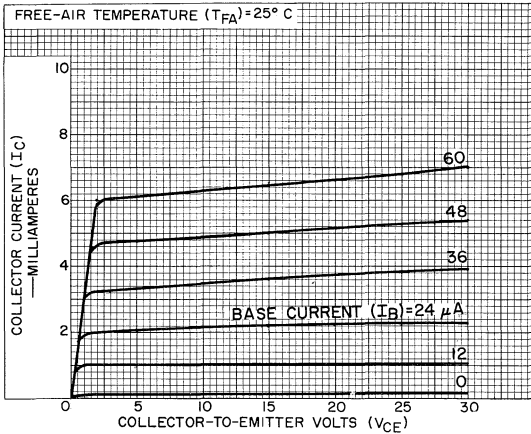
40309 40311 40314 40315
40317 40320 40323 40326



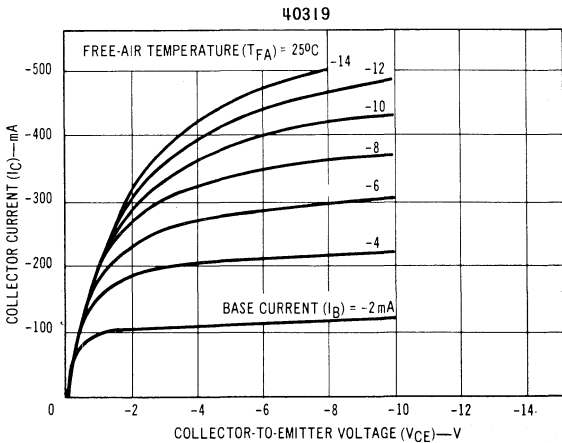
Typical Collector Characteristics

40309 40311 40314

40315 40317 40323



92CS-13003



TL1770C

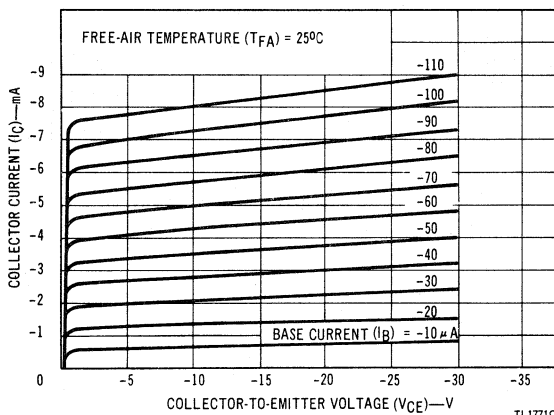


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Electronic Components and Devices Harrison, N. J.

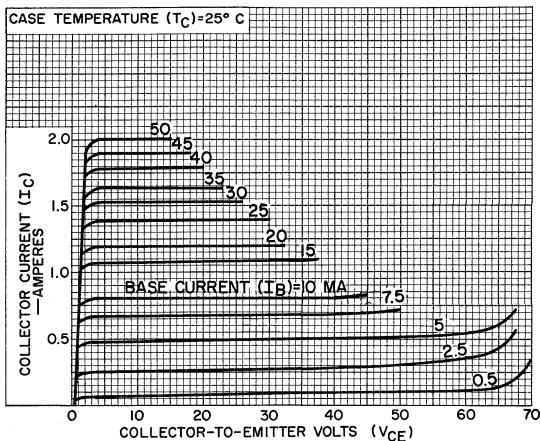
DATA 6
10-65

Typical Collector Characteristics

40319

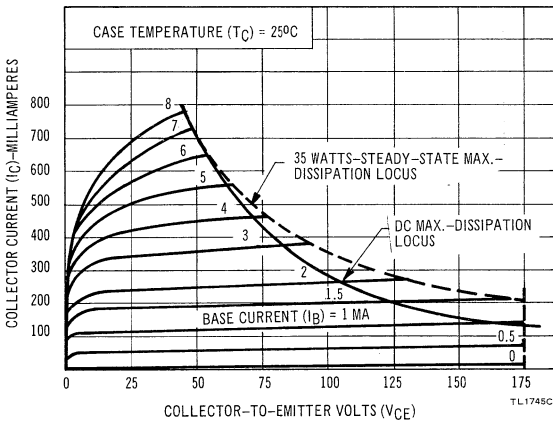


40312

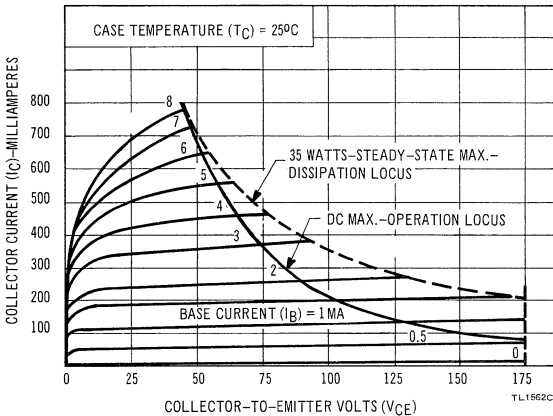


Typical Collector Characteristics

40313



40318 40322 40328



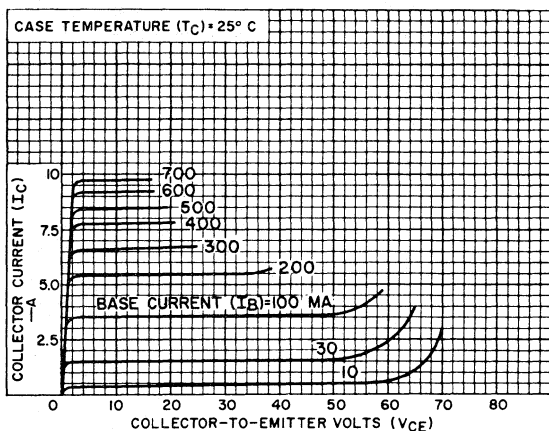
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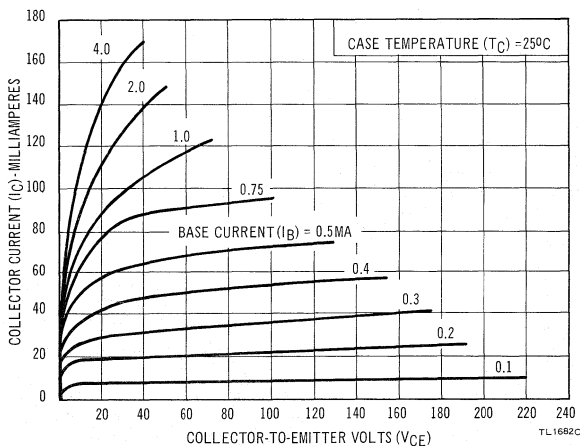
DATA 7
10-65

Typical Collector Characteristics

40325

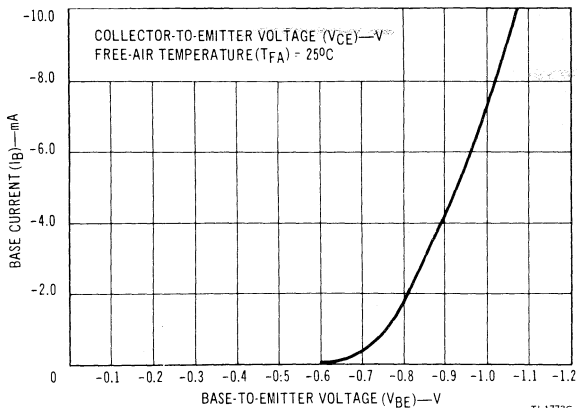


40321 40327

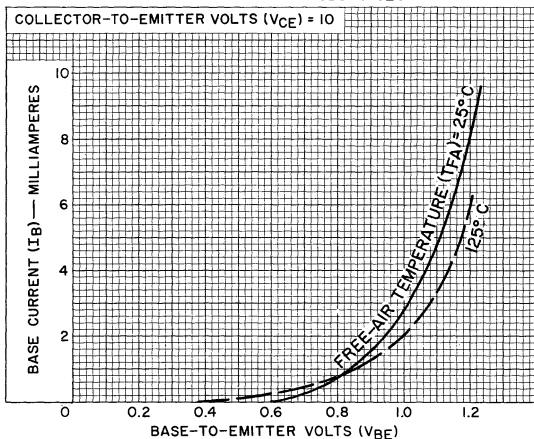


Typical Base (Input) Characteristics

40319



40309 40311 40314 40315
40317 40320 40323 40326



92CS-12329



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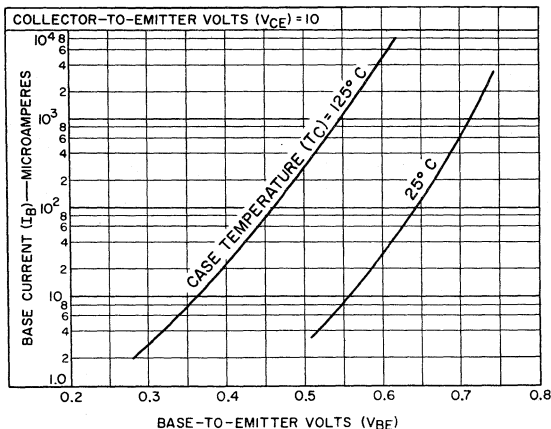
Harrison, N. J.

DATA 8
10-65

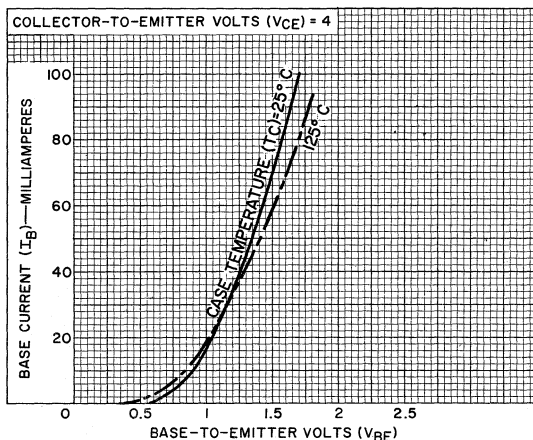
40309 to 40328

Typical Base (Input) Characteristics

40321 40327

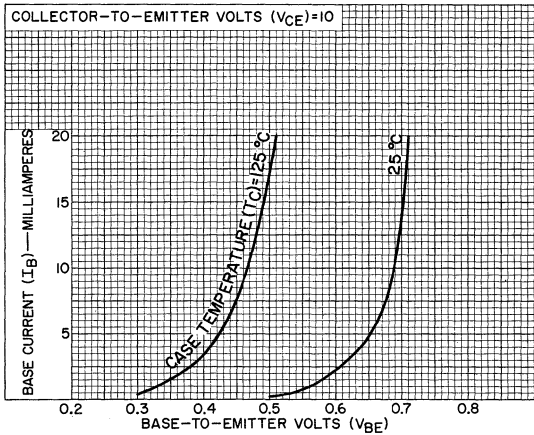


40310 40312 40316 40324



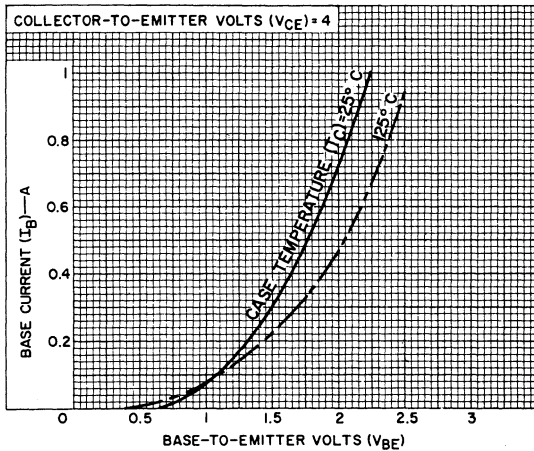
Typical Base (Input) Characteristics

40313 40318 40322 40328



92CS-12881

40325



92CS-12307



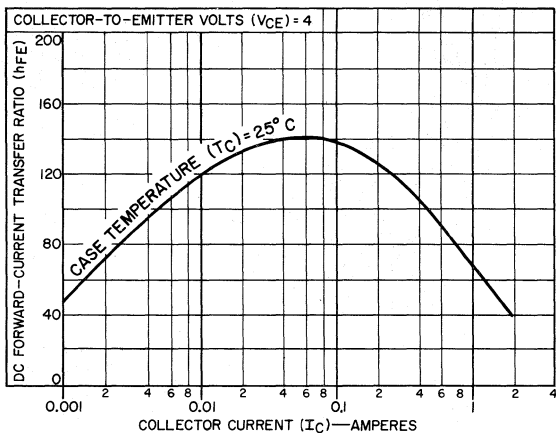
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DATA 9
10-65

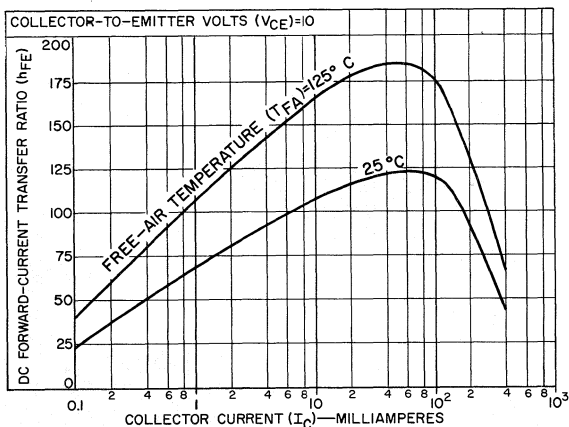
40309 to 40328

Typical h_{FE} (DC Beta) Characteristics

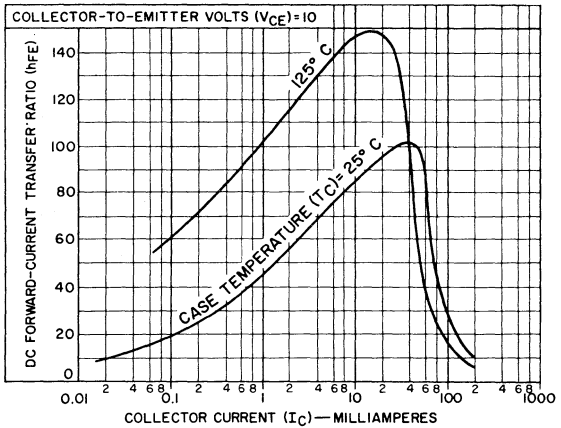
40310 40312 40316 40324



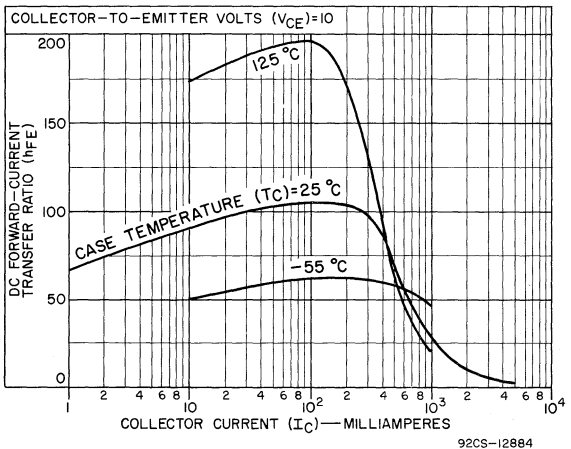
40309 40311 40314 40315
40317 40320 40323 40326



Typical h_{FE} (DC Beta) Characteristics 40321 40327



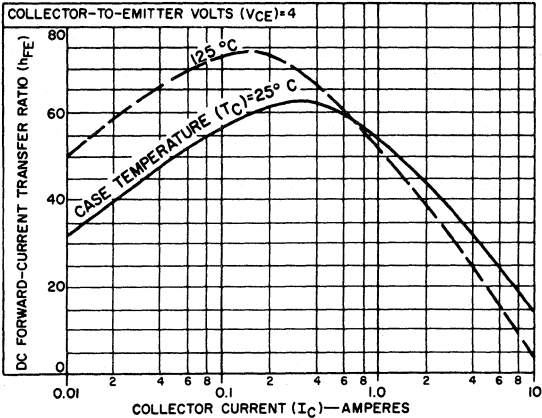
40313 40318 40322 40328



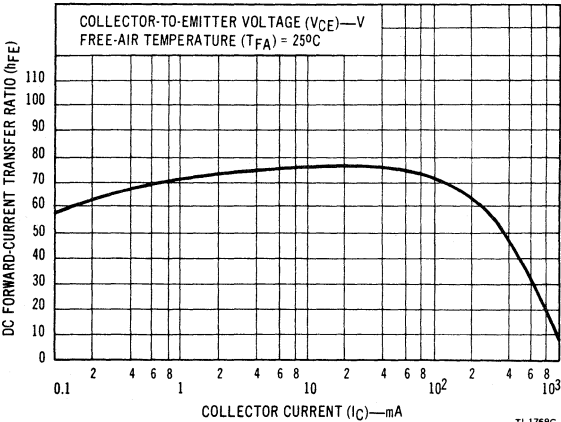
40309 to 40328

Typical h_{FE} (DC Beta) Characteristics

40325

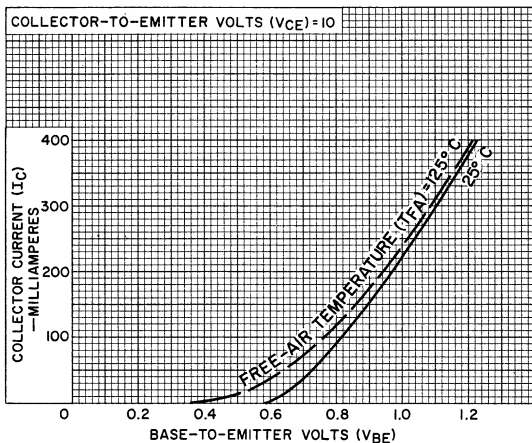


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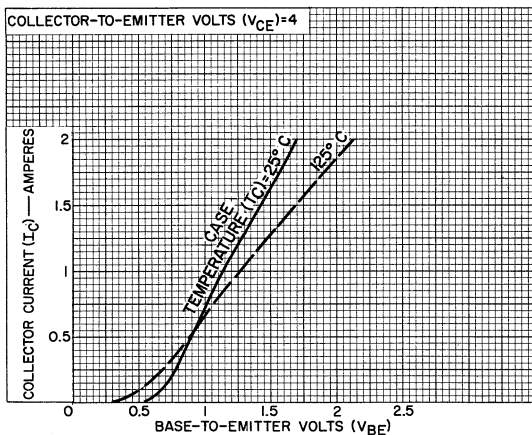
Typical Transfer Characteristics

40309 40311 40314
40315 40317 40323



92CS-12328

40310 40312 40316 40324

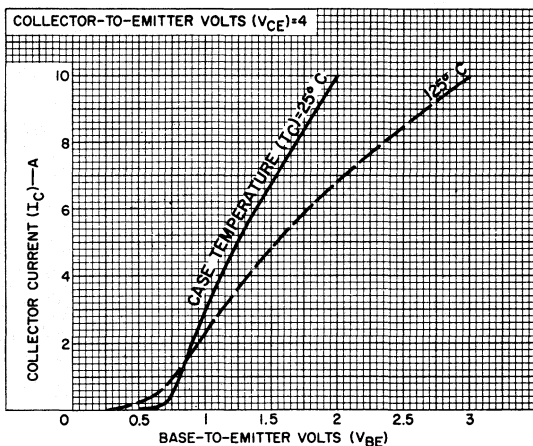


92CS-12325



Typical Transfer Characteristics

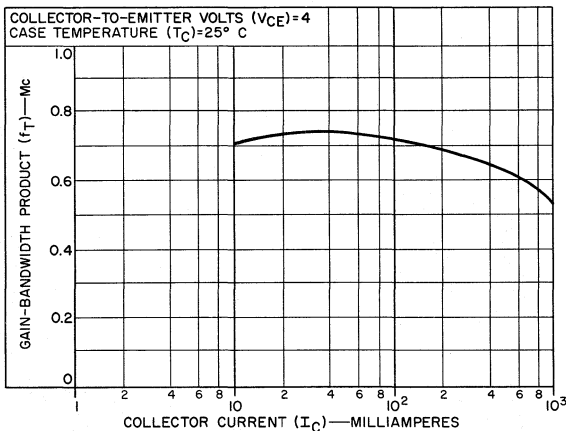
40325



92CS-12326

Typical Gain-Bandwidth Product Characteristic

40325



92CS-12324



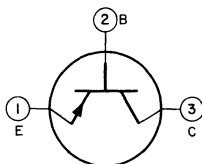
Transistor

GERMANIUM P-N-P ALLOY TYPE

For Low-Level, Intermediate-Level, and Class-A Driver Stages in Consumer and Industrial AF-Amplifier Equipment Such as Pre-amplifiers, Tone-Control Stages, and Phonograph Amplifiers Using Crystal Pickups

Dimensions See Outline TO-1 in General Section
Terminal Diagram BOTTOM VIEW

Lead 1—Emitter
Lead 2—Base



Lead 3—Collector

AMPLIFIER SERVICE

Absolute Maximum Ratings

Collector-to-Base Voltage.	V_{CBO}	-25	V
Collector-to-Emitter Voltage.	V_{CER}	-25	V
$R_{BE} \leq 4700 \Omega$			
Emitter-to-Base Voltage.	V_{EBO}	-2.5	V
Collector Current.	I_C	-100	mA
Emitter Current.	I_E	100	mA
Base Current.	I_B	-20	mA

Transistor Dissipation

With infinite heat sink:

At case temperatures:

From -65° to 55°C P_T 375 mW

Above 55°C Derate linearly 8.35 mW/ $^\circ\text{C}$

With practical heat sink ($\theta = 50^\circ\text{C/W}$):

At free-air temperatures:

From -65° to 55°C P_T 265 mW

Above 55°C Derate linearly 5.9 mW/ $^\circ\text{C}$

Without heat sink:

At free-air temperatures:

From -65° to 55°C P_T 125 mW

Above 55°C Derate linearly 2.8 mW/ $^\circ\text{C}$

Temperature Range

Operating (Junction) T_{opr} -65 to 100 $^\circ\text{C}$

Storage. T_{stg} -65 to 100 $^\circ\text{C}$

Lead-Soldering Temperature^a. 255 $^\circ\text{C}$

For 10 sec. max



ELECTRICAL CHARACTERISTICS

Electrode-voltage and electrode-current values for given test conditions are dc at case temperature = 25°C

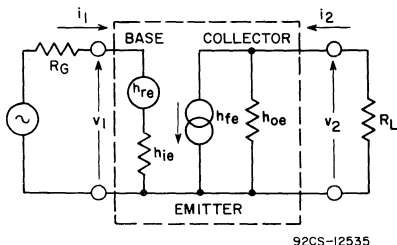
	Min	Typ	Max	
Collector-to-Base				
Breakdown Voltage	BV_{CB0}	-25	-	V
$I_C = -0.05$ mA				
Collector-to-Emitter				
Breakdown Voltage	BV_{CER}	-25	-	V
$R_{BE} = 4700 \Omega$, $I_C = -1$ mA				
Emitter-to-Base				
Breakdown Voltage	BV_{EB0}	-2.5	-	V
$I_E = -0.05$ mA				
Collector-Cutoff Current	I_{CB0}	-	-	μ A
$V_{CB} = -12$ V				
Emitter-Cutoff Current	I_{EB0}	-	-	μ A
$V_{EB} = -2$ V, $I_C = 0$				
DC Forward-Current				
Transfer Ratio.	h_{FE}	50	90	200
$V_{CE} = 1$ V, $I_C = -25$ mA				
Small-Signal Forward-Current Transfer Ratio				
$f = 1$ kc/s,				
$V_{CE} = -10$ V, $I_C = -10$ mA. . .	h_{fe}	75	120	300
$V_{CE} = -6$ V, $I_C = -1$ mA. . .	h_{fe}	50	85	200
Small-Signal Forward Current Transfer Ratio				
Cutoff Frequency.	f_{hfb}	-	1.5	Mc/s
$V_{CB} = -6$ V, $I_C = -1$ mA				
Collector-to-Base Capacitance. .	C_{ob}	-	35	pF
$f = 1$ kc/s, $V_{CB} = -6$ V				
Small-Signal Input Impedance. .	h_{ie}	-	400	Ω
$f = 1$ kc/s, $V_{CE} = -10$ V,				
$I_C = -10$ mA				
Small-Signal Output Admittance. .	h_{oe}	-	175	μ hos
$f = 1$ kc/s, $V_{CE} = -10$ V,				
$I_C = -10$ mA				
Small-Signal Reverse Voltage-Transfer Ratio.				
h_{re}	-	300×10^{-6}	-	
$f = 1$ kc/s, $V_{CE} = -10$ V,				
$I_C = -10$ mA				
Equivalent RMS Noise Input Current -	-	-	0.02	μ A
$f = 20$ c/s to 20 kc/s,				
$V_{CE} = -6$ V, $I_C = -0.5$ mA				
Base-Spreading Resistance. . .	$r_{bb'}$	-	100	Ω
$f = 20$ Mc/s, $V_{CE} = -6$ V,				
$I_C = -1$ mA				

^a Measured along lead at distances not less than 1/32" from seating surfaces.



OPERATING CONSIDERATIONS

Under no circumstances should the case of the 40329 be soldered to a heat sink or chassis because the heat of the soldering operation will permanently damage the transistor.

LOW-FREQUENCY SMALL-SIGNAL EQUIVALENT
CIRCUIT CHARACTERISTICS

$$\text{Input Resistance} = \frac{V_1}{i_1} = \frac{h_{ie} + (\Delta^h R_L)}{1 + (h_{oe} R_L)}$$

$$\text{Output Resistance} = \frac{V_2}{i_2} = \frac{h_{ie} + R_g}{\Delta^h + (h_{oe} R_g)}$$

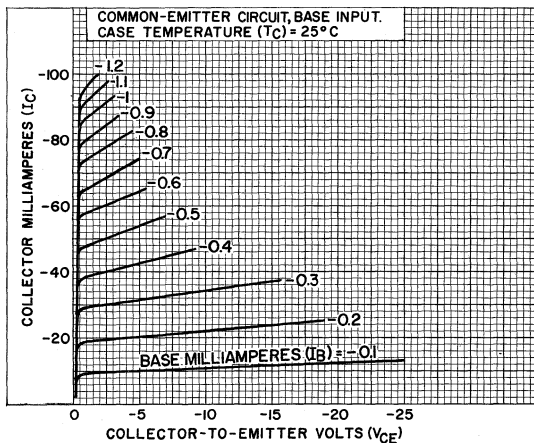
$$\text{Forward Current-Transfer Ratio} = \frac{i_2}{i_1} = \frac{h_{fe}}{1 + (h_{oe} R_L)}$$

$$\text{Forward Voltage-Transfer Ratio} = \frac{V_2}{V_1} = \frac{-h_{fe} R_L}{h_{ie} + (\Delta^h R_L)}$$

- V_1 = ac input signal voltage
- i_1 = ac base current
- V_2 = ac output signal voltage
- i_2 = ac collector current
- h_{ie} = small-signal short-circuit input impedance
- h_{oe} = small-signal open-circuit output admittance
- h_{re} = small-signal open-circuit reverse voltage-transfer ratio
- h_{fe} = small-signal short-circuit forward current-transfer ratio
- $\Delta^h = (h_{ie} h_{oe}) - (h_{re} h_{fe})$
- R_g = generator resistance
- R_L = load resistance

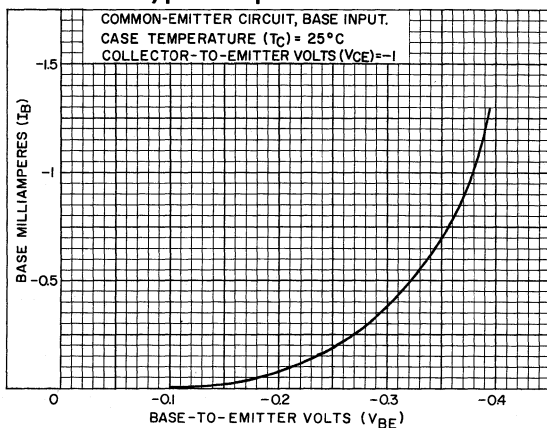


Typical Collector Characteristics



92CS-13142

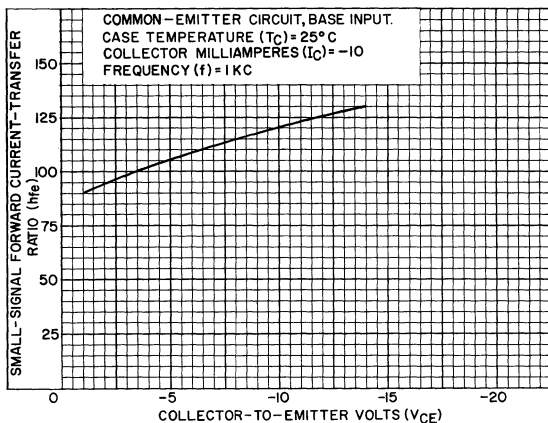
Typical Input Characteristic



92CS-13144

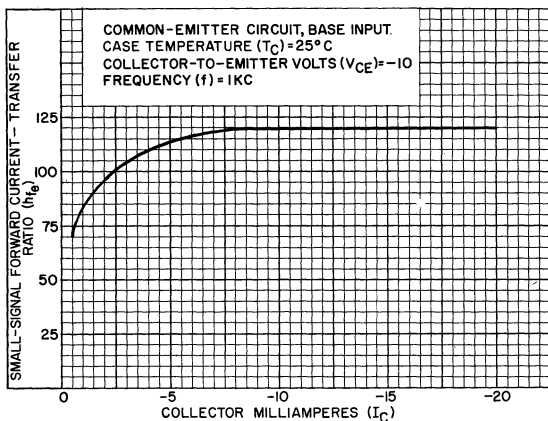


Typical Small-Signal Beta (h_{fe}) Characteristic



92CS-13139

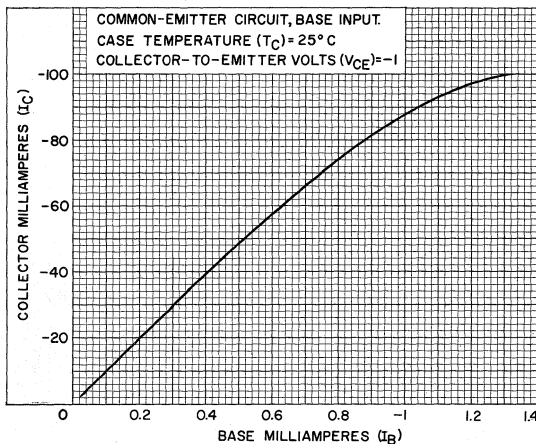
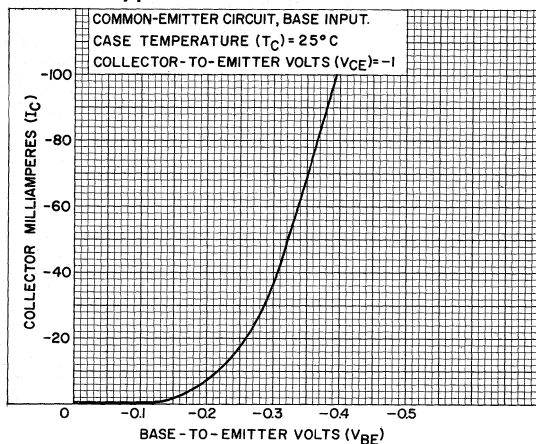
Typical Small-Signal Beta (h_{fe}) Characteristic



92CS-13140



Typical Transfer Characteristics



40340, 40341

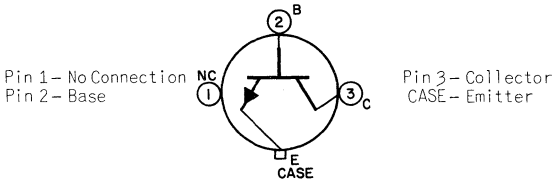
Transistors

SILICON N-P-N "OVERLAY" EPITAXIAL-PLANAR TYPES

*For High-Power, Class-C Amplifier
Applications at Frequencies to 100 Mc/s*

Dimensions. See Outline TO-60 in General Section
Terminal Diagram

BOTTOM VIEW



MAXIMUM RATINGS, ABSOLUTE-MAXIMUM VALUES

	40340	40341	
Collector-to-Base Voltage	V_{CBO}	60	80 V
Collector-to-Emitter Voltage			
With base open.	V_{CEO}	25	35 V
$V_{BE} = -1.5$ V.	V_{CEV}	60	80 V
Emitter-to-Base Voltage	V_{EB0}	4	4 V
Peak Collector Current.		10	10 A
Continuous Collector Current.	I_C	3.3	3.3 A
Transistor Dissipation.	P_T	70	70 W
At 25° C case temperature			
Junction Temperature.	T_J	200	200 °C

ELECTRICAL CHARACTERISTICS

*Electrode voltage and electrode-current values for given
test conditions are dc at case temperature = 25° C*

40340 40341

Collector-to Emitter Breakdown Voltage				
$I_C = 200$ mA ^a , $V_{BE} = -1.5$ V. . .	BV_{CEV}	60	80	min V
$I_C = 200$ mA ^a , $I_B = 0$	BV_{CEO}	25	35	min V
Emitter-to-Base Breakdown Voltage.	BV_{EB0}	4	4	min V
$I_E = 10$ mA, $I_C = 0$				
Collector Cutoff Current				
$V_{CE} = 30$ V, $I_B = 0$	I_{CEO}	-	1	max mA
$V_{CE} = 15$ V, $I_B = 0$	I_{CEO}	1	-	max mA
Collector Cutoff Current				
$V_{CB} = 60$ V, $I_E = 0$	I_{CBO}	-	10	max mA
$V_{CB} = 40$ V, $I_E = 0$	I_{CBO}	10	-	max mA
Output Capacitance				
$V_{CB} = 30$ V, $I_E = 0$	C_{ob}	-	85	max pF
$V_{CB} = 15$ V, $I_E = 0$	C_{ob}	120	-	max pF



40340, 40341

40340 40341

Power Output^b

$f = 50 \text{ Mc/s}$, $V_{CE} = 24 \text{ V}$,

$P_i = 3 \text{ W}$ P_o - 30^c min W

$f = 50 \text{ Mc/s}$, $V_{CE} = 13.5 \text{ V}$,

$P_i = 5 \text{ W}$ P_o 25^d - min W

Thermal Resistance θ_{JC} 2.5 2.5 max °C/W
Junction-to-Case

^a Pulsed through an inductor (25 mH); duty factor = 0.5.

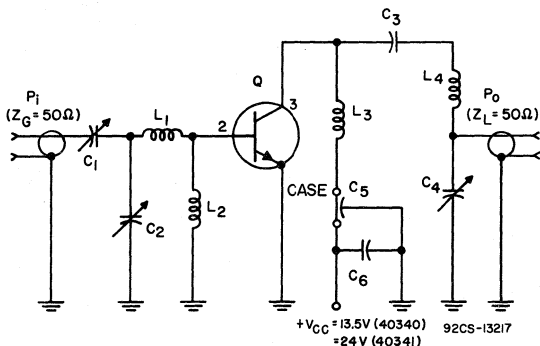
^b See accompanying *Power-Output-Measurement Circuit*.

^c For conditions given, minimum efficiency = 60 per cent.

^d For conditions given, minimum efficiency = 65 per cent.

POWER-OUTPUT MEASUREMENT CIRCUIT

RF Amplifier, 50 Mc/s



- C₁: 70-350 pF
- C₂: 90-400 pF
- C₃: 14-150 pF
- C₄: 32-250 pF
- C₅: 1000 pF
- C₆: 0.025 μF
- L₁: 1 turn No.16 wire,
5/16" ID, 1/8" long
- L₂: 0.27 Ω, wire-wound

For 40340

- L₃: 3 turns No.16 wire,
3/8" ID, 1/2" long
- L₄: 4 turns No.10 wire,
5/8" ID, 3/4" long

For 40341

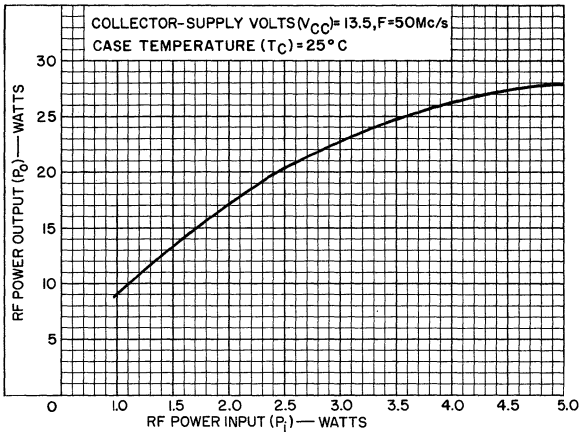
- L₃: 3 turns B & W No.3002
coil stock (or equivalent)
- L₄: 5 turns B & W No.3006
coil stock (or equivalent)

Q: Type 40340 or 40341



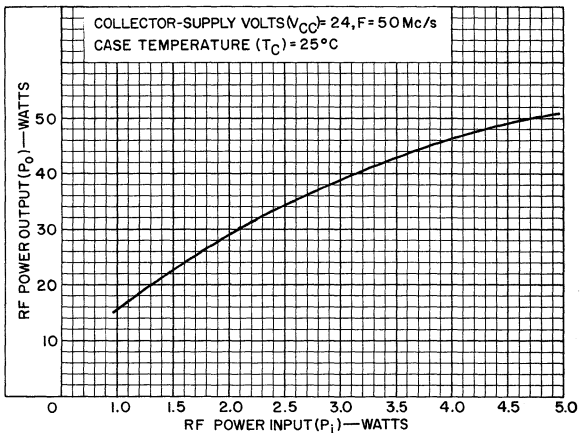
RF Power Output vs. RF Power Input

50-Mc/s Operation, 40340



92CS-13216

50-Mc/s Operation, 40341



92CS-13215



Transistors

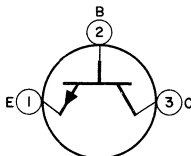
SILICON N-P-N "OVERLAY" EPITAXIAL-PLANAR TYPES

For Ultra-High Reliability, Large-Signal, High-Power, VHF-UHF Applications in Space, Industrial and Military Communications Equipment for Class-A, -B, or -C Amplifier, Frequency Multiplier, or Oscillator Operation

MECHANICAL

Dimensions See Outline TO-60 in General Section
Terminal Diagram BOTTOM VIEW

Pin 1 - Emitter
Pin 2 - Base



Pin 3 - Collector

RADIO-FREQUENCY SERVICE

Maximum Ratings, Absolute-Maximum Values

Collector-to-Base Voltage.	V_{CB0}	65	V
Collector-to-Emitter Voltage			
With base open	V_{CEV}	40	V
With $V_{BE} = -1.5$ V.	V_{CE0}	65	V
Emitter-to-Base Voltage.	V_{EB0}	4	V
Peak Collector Current		3	A
Transistor Dissipation			
At case temperatures:			
From -65° to 25°C	P_T	23	W
Above 25°C	Derate linearly to 0 W at 200°C		
Temperature Range			
Operating (Junction)	T_{opr}	-65 to 200	$^{\circ}\text{C}$
Storage.	T_{stg}	-65 to 200	$^{\circ}\text{C}$
Pin-Soldering Temperature ^a	T_P	230	$^{\circ}\text{C}$
(For 10 sec. max.)			

ELECTRICAL CHARACTERISTICS

Electrode-voltage and electrode-current values for given test conditions are dc at case temperature = 25°C

	40342, 40343		
	Min	Max	
Collector-to-Base Breakdown Voltage . BV_{CB0}	65	-	V
$I_C = 0.5$ mA, $I_E = 0$			
Collector-to-Emitter Breakdown Voltage			
I_C (Pulsed) = 0 to 200 mA, ^b			
$V_{BE} = -1.5$ V.	BV_{CEV}	65°	V
I_C (Pulsed) = 0 to 200 mA, ^b			
$I_B = 0$	BV_{CE0}	40°	V
Emitter-to-Base Breakdown Voltage. . BV_{EB0}	4	-	V
Collector-to-Emitter Saturation			
Voltage	$V_{CE(sat)}$	-	V
$I_C = 0.5$ A, $I_B = 100$ mA			



40342, 40343

		40342, 40343		
		Min	Max	
Collector-Cutoff Current	I_{CE0}	-	0.25	μA
$V_{CE} = 30 V, I_B = 0$				
DC Forward-Current Transfer Ratio.	h_{FE}	10	-	
$V_{CE} = 5 V, I_C = 300 mA$				
Output Capacitance	C_{ob}	-	20	pF
$f = 1 Mc/s, V_{CB} = 30 V, I_E = 0$				
RF Power Output Amplifier, Unneutralized ^d				
40342: $f = 175 Mc/s, V_{CE} = 28 V,$				
$P_i = 3.5 W.$	P_o	13.5 ^e	-	W
40343: $f = 400 Mc/s, V_{CE} = 28 V,$				
$P_i = 4 W.$	P_o	10 ^f	-	W

a Measured along pin at distances $\geq 1/32"$ from insulating wafer.

b Pulsed through an inductor ($25 \mu H$); duty factor = 0.5.

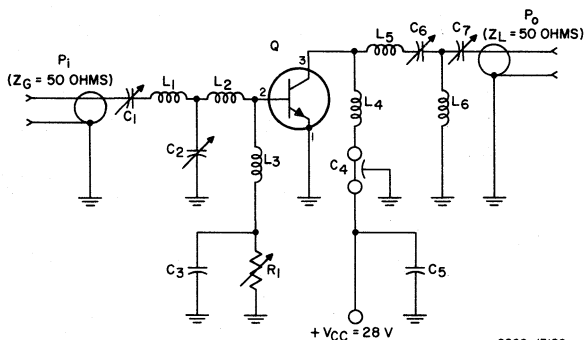
c Measured at a current where the breakdown voltage is a minimum.

d See accompanying Power-Output-Measurement Circuits.

e For conditions given, minimum efficiency = 70%.

f For conditions given, minimum efficiency = 45%.

POWER-OUTPUT MEASUREMENT CIRCUIT Unneutralized RF Amplifier, 175 Mc/s 40342



92CS-13120

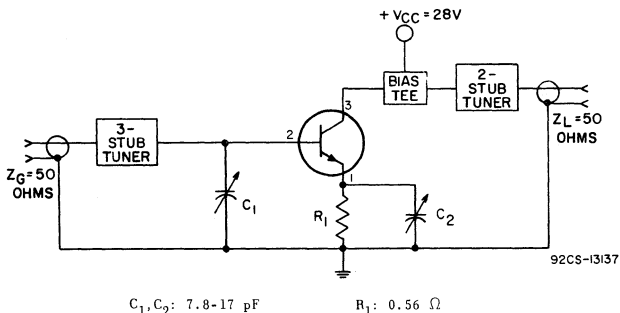
C_1, C_6 : 3-35 pF
 C_2, C_7 : 8-60 pF
 C_4 : 1,000 pF
 C_3, C_5 : 0.005 μF ,
 disc ceramic

L_1, L_5 : 4 turns No. 18 wire,
 1/4" ID, 3/16" long
 L_2 : 1 turn No. 16 wire,
 1/4" ID, 3/16" long
 L_3 : Ferrite choke, $Z = 450 ohms$

L_4 : RF choke, 1.0 μH
 L_6 : 2-1/2 turns
 No. 16 wire, 1/4"
 ID, 1/4" long
 R_1 : 50 Ω



POWER-OUTPUT MEASUREMENT CIRCUIT
Unneutralized RF Amplifier, 400 Mc/s
40343



RELIABILITY TESTING

In addition to Preconditioning and Group A tests, a Qualification Approval test series (Group B tests) is performed on each lot. All units are tested to assure freedom from second breakdown in Class-A applications.

Preconditioning (100 Per Cent Testing of Each Transistor)

1. Serialization
 2. Record I_{CEO} , h_{FE} , $V_{CE(sat)}$
 3. Temperature Cycling-Method 102A of MIL-STD-202, 5 cycles, -65°C 200°C
 4. Bake, 72 hours minimum, 200°C
 5. Constant Acceleration-Method 2006 of MIL-STD-750, 10,000g, Y_1 and Y_2 axes
 6. Record I_{CEO} , h_{FE} , $V_{CE(sat)}$
 7. Reverse Bias Age, $T_{FA} = 150^\circ\text{C}$, $V_{CB} = 28$ volts, $t = 168$ hours
 8. Record I_{CEO} , h_{FE} , $V_{CE(sat)}$
 9. Power Age, $T_{FA} = 25^\circ\text{C}$, $V_{CB} = 28$ volts, $t = 500$ hours, $P_T = 2.6$ watts, free air
 10. Record I_{CEO} , h_{FE} , $V_{CE(sat)}$ at 168 hours and 500 hours
 11. Helium Leak, 1×10^{-8} cc/sec. max.
 12. Methanol Bomb, 70 psig, 18 to 24 hours
 13. X-Ray, RCA spec. 1750326
 14. Record Subgroups 2 and 3 of Group A Tests
- 9 Delta criteria after 168 hours Reverse Bias Age and after 168 hours and 500 hour Power Age
- | | |
|----------------------|---|
| ΔI_{CEO} | +100% or +25 nanoamperes whichever is greater |
| Δh_{FE} | $\pm 30\%$ |
| $\Delta V_{CE(sat)}$ | ± 0.1 volts |



40342, 40343

Group A Tests

40342, 40343

TEST METHOD ^h	EXAMINATION OR TEST & CONDITIONS	LIMITS		
		Min	Max	
SUBGROUP 1 — LTPD-10				
207I	Visual and Mechanical Examination			
SUBGROUP 2 — LTPD-5				
304ID	Collector-to-Emitter Cutoff Current $V_{CE} = 30 \text{ V}$, $I_B = 0$	I_{CEO}	- 250	nA
300ID	Collector-to-Base Breakdown Voltage. $I_C = 500 \mu\text{A}$, $I_E = 0$	BV_{CBO}	65 -	V
3026B	Emitter-to-Base Breakdown Voltage. $I_E = 250 \mu\text{A}$, $I_C = 0$	BV_{EBO}	4 -	V
301ID	Collector-to-Emitter Breakdown Voltage. $I_C = 0$ to 200 ^k mA (Inductive), $I_B = 0$	BV_{CEO}	40 ^j -	V
301IA	Collector-to-Emitter Breakdown Voltage. $I_C = 0$ to 200 ^k mA (Inductive), $V_{BE} = -1.5 \text{ V}$	BV_{CEV}	65 ^j -	V
307I	Collector-to-Emitter Saturation Voltage $I_C = 500 \text{ mA}$, $I_B = 100 \text{ mA}$	$V_{CE(sat)}$	- 1	V
3076	Forward Current Transfer Ratio $I_C = 300 \text{ mA}$, $V_{CE} = 5 \text{ V}$	h_{FE}	10 -	
SUBGROUP 3 — LTPD-5				
3236	Output Capacitance. $f = 140 \text{ kc/s}$, $V_{CB} = 30 \text{ V}$, $I_E = 0$	C_{ob}	- 20	pF
^m	RF Power Output (Min. eff. = 70%) $V_{CE} = 28 \text{ V}$, $P_i = 3.5 \text{ W}$, $f = 1 \text{ Mc/s}$	P_o	13.5 -	W
ⁿ	RF Power Output (Min. eff. = 45%) $V_{CE} = 28 \text{ V}$, $P_i = 4 \text{ W}$, $f = 400 \text{ Mc/s}$	P_o	10 -	W
SUBGROUP 4 — LTPD-15				
3036D	Collector Cutoff Current. $T_{FA} = 150^\circ\text{C} \pm 3^\circ\text{C}$, $V_{CB} = 30 \text{ V}$, $I_E = 0$	I_{CBO}	- 250	μA
3076	Forward Current Transfer Ratio $T_{FA} = 150^\circ\text{C} \pm 3^\circ\text{C}$, $I_C = 300 \text{ mA}$, $V_{CE} = 5 \text{ V}$	h_{FE}	- 200	

^h Per Mil-Std-750.

^j Measured at a current where the breakdown voltage is a minimum.

^k Pulsed through an inductor (25 μH); duty factor = 0.5.

^m See circuit, Unneutralized RF Amplifier, 175 Mc/s

ⁿ See circuit, Unneutralized RF Amplifier, 400 Mc/s.

^p Acceptance/Rejection Criteria of Group B tests: For an LTPD plan of 7% the total sample size is 80 for which the maximum number of rejects allowed is 2. Acceptance is also subject to a maximum of one (1) reject per Sub-group.

^q Pulsed through an inductor (25 mH); duty factor = 0.5.



Group B Tests^p - Made on each lot for Qualification or Lot Acceptance

TEST METHOD ^h	EXAMINATION OR TEST & CONDITIONS	40342, 40343 LIMITS	
		Min	Max
	SUBGROUP 1 — LTPD-7 (10 Samples)		
2066	Physical Dimensions JEDEC TO-60 Pkg.	-	-
202/102A	Temperature Cycle 5 c/s, -65°C, 200°C	-	-
1056B	Thermal Shock 0°C, 100°C	-	-
1021	Moisture Resistance Omit lead fatigue.	-	-
2036D	Torque-to-Stud 1 minute, 12 inch pounds	-	-
	SUBGROUP 2 — LTPD-7 (10 Samples)		
2016	Impact Shock 500 g, 5 blows X_1, Y_1, Z_1 , 1 ms	-	-
2046	Vibration Fatigue	-	-
2056	Vibration Variable Freq.	-	-
	SUBGROUP 3 — LTPD-7 (10 Samples)		
2026	Solderability	-	-
1066	Dew Point 25°C, -65°C; read I_{CEO}	-	-
1001	Barometric Pressure 100,000 ft.; read I_{CEO}	-	-
	SUBGROUP 4 — LTPD-7 (25 Samples)		
1031	Storage Life 200°C, 1,000 hr	-	-
2006	Constant Acceleration 20,000 g, Y_1, Y_2	-	-
	SUBGROUP 5 — LTPD-7 (25 Samples)		
1026	Operating Life 1,000 hr, $T_C = 170^\circ\text{C}$, $V_{CB} = 28\text{ V}$, $P_T = 4\text{ W}$	-	-
	END POINTS — SUBGROUPS 1, 2, 3, 4, 5		
3041D	Collector-Cutoff Current . . . I_{CEO} $V_{CE} = 30$, $I_B = 0$	-	2.5 μA
3011A	Collector-to-Emitter Breakdown Voltage BV_{CEV} $I_C = 0$ to 200 ^q mA (Inductive) $V_{BE} = -1.5\text{ V}$	60 ^j	- V
m	RF Power Output (Min. eff. = 70%) P_O $V_{CE} = 28\text{ V}$, $P_i = 3.5\text{ W}$, $f = 175\text{ Mc/s}$	12.5	- W
n	RF Power Output (Min. eff. = 45%) P_O $V_{CE} = 28\text{ V}$, $P_i = 4.0\text{ W}$, $f = 400\text{ Mc/s}$	9.0	- W
3076	DC Forward-Current Transfer Ratio h_{FE} $I_C = 300\text{ mA}$, $V_{CE} = 5\text{ V}$	9	-



40342, 40343

TEST
METHOD^h

EXAMINATION OR
TEST & CONDITIONS

40342, 40343

LIMITS

Min Max

3026D

END POINTS — SUBGROUPS 1,2,3,4,5

Emitter-to-Base

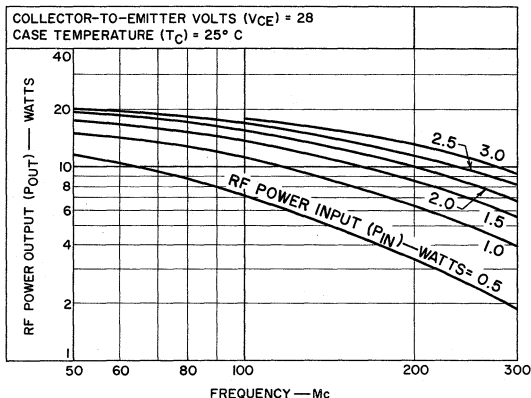
Breakdown Voltage BV_{EB0}

3.5 - V

$I_E = 250$ mA, $I_C = 0$

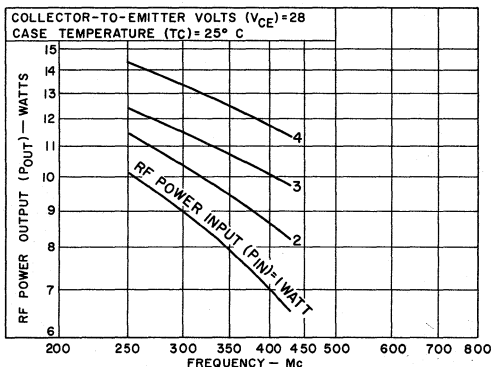
Typical Operation Characteristics

40342



92CS-12829

40343



92CS-13134



Power Transistor

HIGH-VOLTAGE SILICON N-P-N TRIPLE-DIFFUSED PLANAR TYPE

HIGH BREAKDOWN VOLTAGE

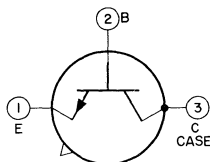
LOW SATURATION VOLTAGE

For Low-Power, High-Voltage, General-Purpose Applications in Military, Industrial and Commercial Equipment. Particularly Useful in Neon Indicators and NIXIE^a Driver Circuits, and in High-Voltage Differential and High-Voltage Operational Amplifiers.

Dimensions. See Outline TO-5 in General Section
Terminal Diagram

BOTTOM VIEW

Lead 1—Emitter
Lead 2—Base



Lead 3—Collector,
Case

ABSOLUTE-MAXIMUM RATINGS

Collector-to-Emitter Voltage.	V _{CE} (sus)	175	V
R _{BE} = 1000 Ω			
Collector Current	I _C	1	A
Base Current.	I _B	0.5	A
Transistor Dissipation			
At case temperatures:			
From -65° to 50° C.	P _T	5	W
Above 50° C	Derate linearly to 0 W at 200° C		
At free-air temperatures:			
From -65° to 50° C.	P _T	1	W
Above 50° C	Derate linearly to 0 W at 200° C		
Operating Temperature Range	T _(opr)	-65 to 200	°C

ELECTRICAL CHARACTERISTICS

Unless otherwise specified, electrode-voltage and electrode-current values for given test conditions are dc at case temperature = 25° C

Base-to-Emitter Voltage	V_{BE}	1 max	V
$V_{CE} = 10$ V, $I_C = 10$ mA			
Collector-to-Emitter Sustaining Voltage	$V_{CE}(sus)$	175 min	V
$R_{BE} = 1000 \Omega$, $I_C = 50$ mA			
Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$	0.5 max	V
$I_B = 1$ mA, $I_C = 10$ mA			



RADIO CORPORATION OF AMERICA
Electronic Components and Devices

Harrison, N. J.

DATA 1
9-65

Collector-Cutoff Current

$T_C = 25^\circ\text{C}$, $V_{CE} = 200\text{ V}$, $V_{EB} = 1.5\text{ V}$. . . I_{CEV} 10 max μA

$T_C = 150^\circ\text{C}$, $V_{CE} = 200\text{ V}$, $V_{EB} = 1.5\text{ V}$. . . I_{CEV} 1 max mA

With base open. I_{CEO} 5 max μA

Emitter-Cutoff Current. I_{EBO} 5 max μA

$V_{EB} = 4\text{ V}$

DC Forward-Current Transfer Ratio . . . h_{FE} 25 min

$V_{CE} = 10\text{ V}$, $I_C = 10\text{ mA}$

Small-Signal, Forward-Current

Transfer Ratio h_{fe} 2 min

$f = 5\text{ Mc/s}$, $V_{CE} = 10\text{ V}$, $I_C = 10\text{ mA}$

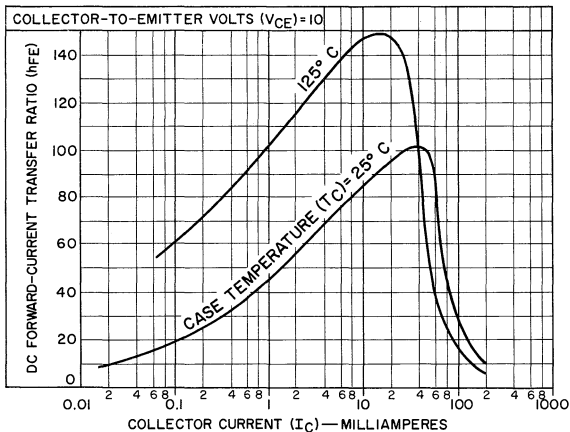
Thermal Resistance. θ_{JC} 30 max $^\circ\text{C/W}$

Junction-to-case

^a Nixie is a Registered Trademark of Burroughs Corporation, Electronic Components Division, Plainfield, N.J.

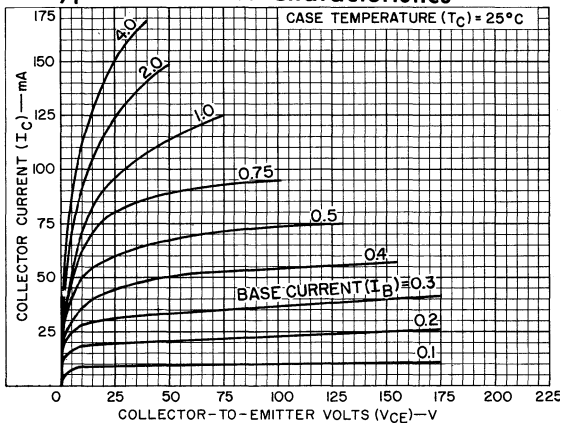


Typical DC-Beta (h_{FE}) Characteristics



92CS-12615

Typical Collector Characteristics



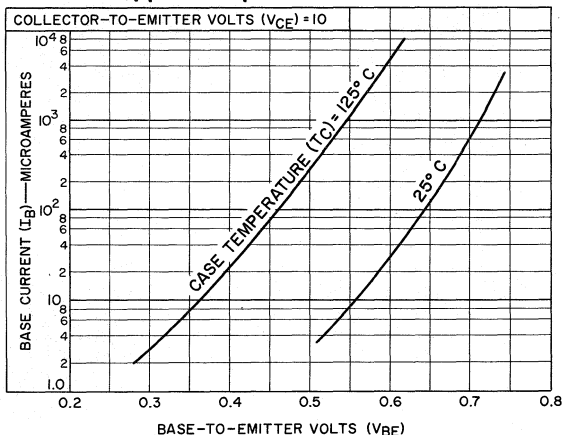
92CS-13210



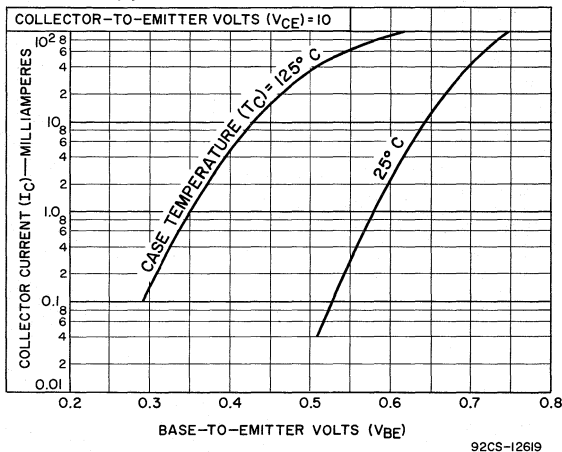
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DATA 2
9-65

Typical Input Characteristics



Typical Transfer Characteristics



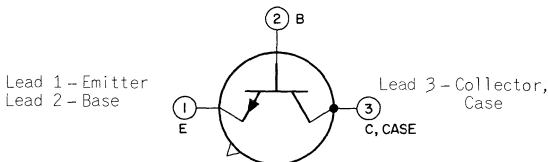
Power Transistors

SILICON N-P-N SINGLE-DIFFUSED TYPES HIGH SECOND-BREAKDOWN RESISTANCES

*For a Wide Variety of Low- and Medium-Power Applications
Requiring Medium and High-Voltage Power Transistors such
as Switching Regulators, Converters, Inverters, Relay
Controls, Oscillators, and Pulse & Audio Amplifiers*

Dimensions See Outline TO-5 in General Section
Terminal Diagram

BOTTOM VIEW



ABSOLUTE-MAXIMUM RATINGS

		40347	40348	40349	
Collector-to-Base Voltage. . .	V_{CB0}	60	90	160	V
Collector-to-Emitter Voltage					
$V_{BE} = -1.5$ V	V_{CEV}	60	90	160	V
Base open.	V_{CEO}	40	65	140	V
Emitter-to-Base Voltage. . .	V_{EB0}	7	7	7	V
Collector Current.	I_C	1	1	1	A
Base Current	I_B	0.5	0.5	0.5	A
Transistor Dissipation					
At case temperatures:					
From -65° to 50°C	P_T	5	5	5	W
Above 50°C	Derate linearly to 0W at 200°C				
At free-air temperatures:					
From -65° to 50°C	P_T	1	1	1	W
Above 50°C	Derate linearly to 0W at 200°C				
Temperature Range					
Operating (Junction)	$T(\text{opr})$	-65 to 200			$^{\circ}\text{C}$
Storage.	$T(\text{stg})$	-65 to 200			$^{\circ}\text{C}$
Lead-Soldering Temperature ^a . .		230	230	230	$^{\circ}\text{C}$
For 10 sec. max					

ELECTRICAL CHARACTERISTICS

*Unless otherwise specified, electrode voltage
and electrode-current values for given test
conditions are dc at case temperature = 25°C*

40347 40348 40349					
Base-to-Emitter Voltage					
$V_{CE} = 4$ V, $I_C = 150$ mA . . .	V_{BE}	1.5	-	max	V
$V_{CE} = 4$ V, $I_C = 300$ mA . . .	V_{BE}	-	1.3	max	V
$V_{CE} = 4$ V, $I_C = 450$ mA . . .	V_{BE}	-	-	1.1 max	V



40347, 40348, 40349

40347 40348 40349

Collector-to-Emitter

Sustaining Voltage

$V_{BE} = -1.5$ V, $I_C = 50$ mA

Base open.

$V_{CEV(sus)}$	60	90	160 ^b	min	V
$V_{CEO(sus)}$	40	65	140 ^b	min	V

Collector-to-Emitter

Saturation Voltage

$I_C = 150$ mA, $I_B = 15$ mA.

$I_C = 300$ mA, $I_B = 30$ mA.

$I_C = 450$ mA, $I_B = 45$ mA.

$V_{CE(sat)}$	-	-	0.5	max	V
$V_{CE(sat)}$	-	0.75	-	max	V
$V_{CE(sat)}$	1	-	-	max	V

Collector Cutoff Current

$V_{CE} = 30$

$V_{CE} = 60$

$V_{CE} = 100$

$T_C = 150^\circ\text{C}$, $V_{CE} = 30$. .

$T_C = 150^\circ\text{C}$, $V_{CE} = 60$. .

$T_C = 150^\circ\text{C}$, $V_{CE} = 100$ V,

$V_{EB} = 1.5$ V.

I_{CEO}	1	-	-	max	μA
I_{CEO}	-	1	-	max	μA
I_{CEO}	-	-	10	max	μA
I_{CEO}	1	-	-	max	mA
I_{CEO}	-	3	-	max	mA

Emitter-Cutoff Current

$V_{EB} = 7$ V

I_{CEV}	-	-	1	max	mA
I_{EB0}	10	10	10	max	μA

DC Forward-Current

Transfer Ratio

$V_{CE} = 4$ V, $I_C = 150$ mA .

$I_C = 150$ mA .

$I_C = 300$ mA .

$I_C = 300$ mA .

$I_C = 450$ mA .

$I_C = 450$ mA .

$I_C = 1$ A.

h_{FE}	-	-	25	min
h_{FE}	-	-	100	max
h_{FE}	-	30	-	min
h_{FE}	-	100	-	max
h_{FE}	20	-	10	min
h_{FE}	80	-	-	max
h_{FE}	-	10	-	min

Thermal Resistance . . .

Junction-to-Case

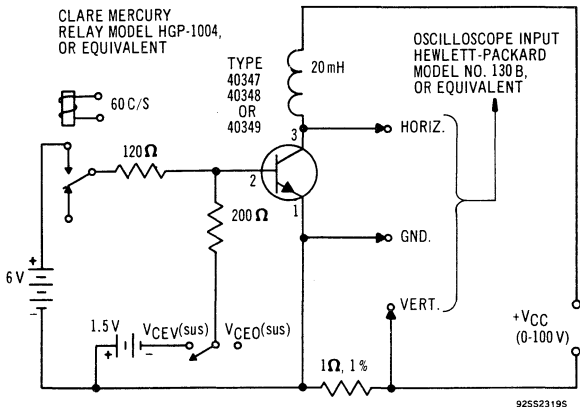
θ_{JC}	20	20	20	max	$^\circ\text{C/W}$
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^a Measured along lead at distances $\geq 1/32$ inch from seating plane.

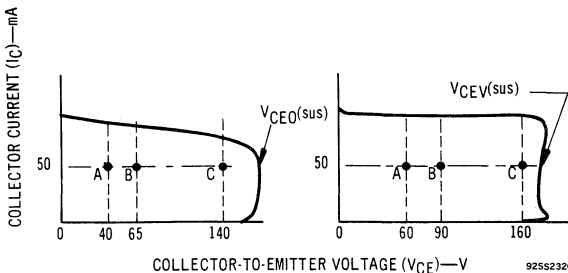
^b **CAUTION:** The sustaining voltages $V_{CEO(sus)}$ and $V_{CEV(sus)}$ **MUST NOT** be measured on a curve tracer. These sustaining voltages should be measured by means of the test circuit shown in *Test Circuit Used to Measure Sustaining Voltages*.



SUSTAINING VOLTAGE TEST CIRCUIT $V_{CE0(sus)}$ & $V_{CEV(sus)}$ 40347, 40348 & 40349



OSCILLOSCOPE DISPLAY FOR MEASUREMENT OF SUSTAINING VOLTAGES



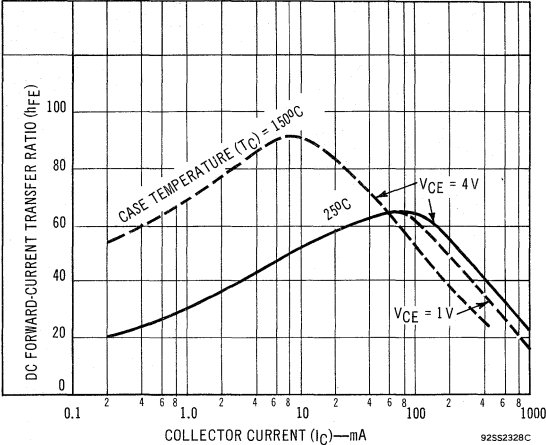
Note: The sustaining voltages $V_{CE0(sus)}$ and $V_{CEV(sus)}$ are acceptable when the traces fall to the right and above points "A", "B", and "C" for the types 40347, 40348, and 40349, respectively.



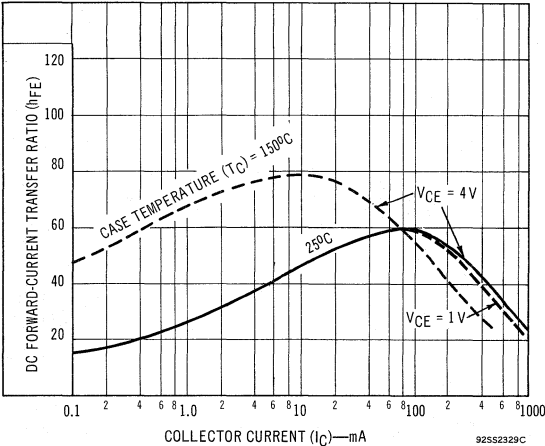
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DATA 2
 10-65

Typical DC-Beta Characteristics
40347

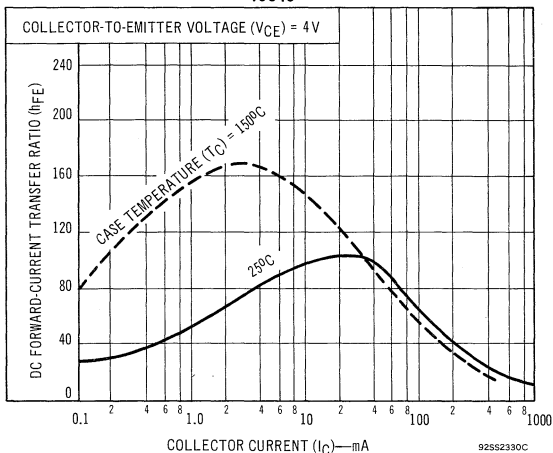


40348



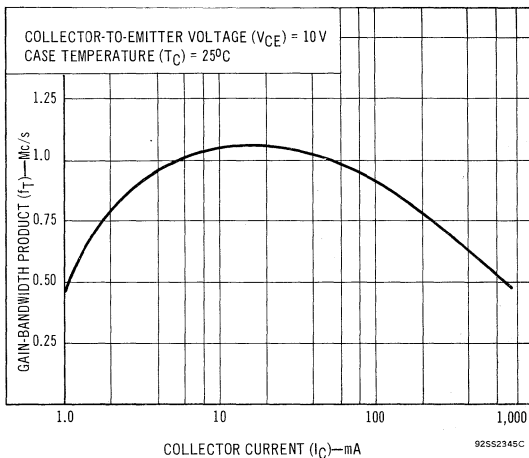
Typical DC-Beta Characteristics

40349



Typical Gain-Bandwidth Product vs. Collector Current

40347, 40348 & 40349

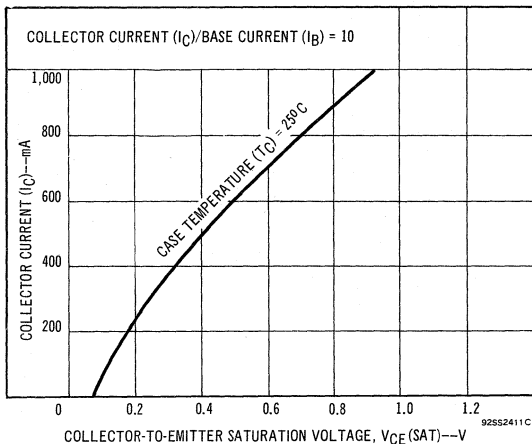


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DATA 8
1-13

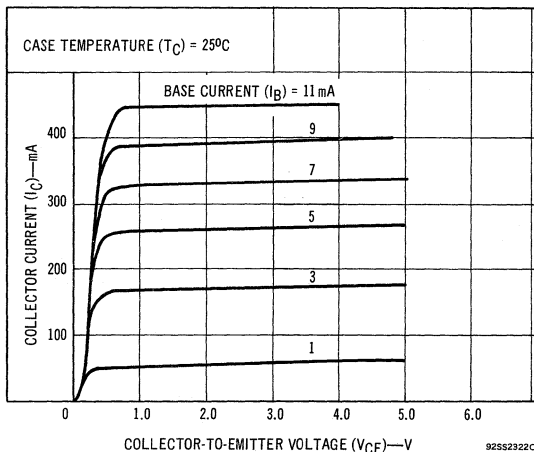
Typical Output Characteristic

40347 & 40348



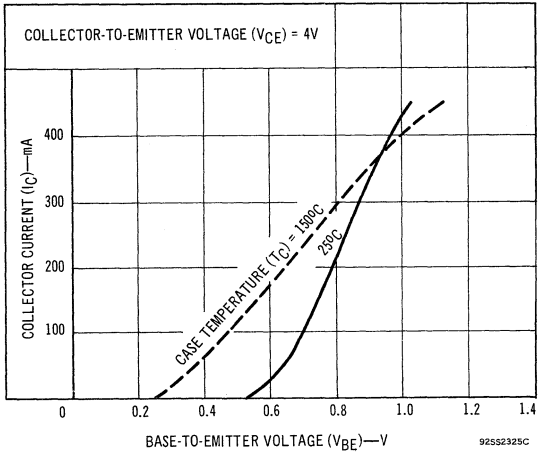
Typical Operation Characteristics

40347

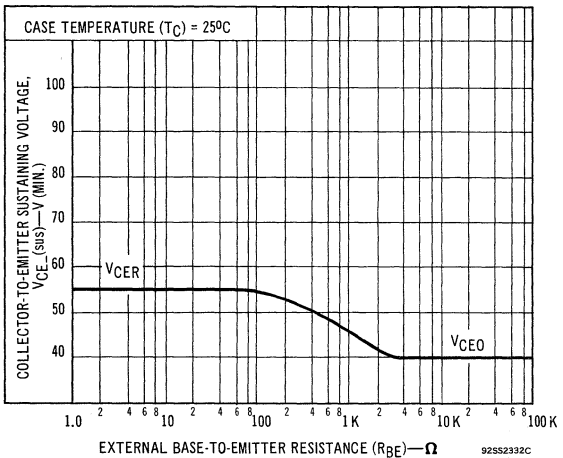


Typical Operation Characteristics

40347

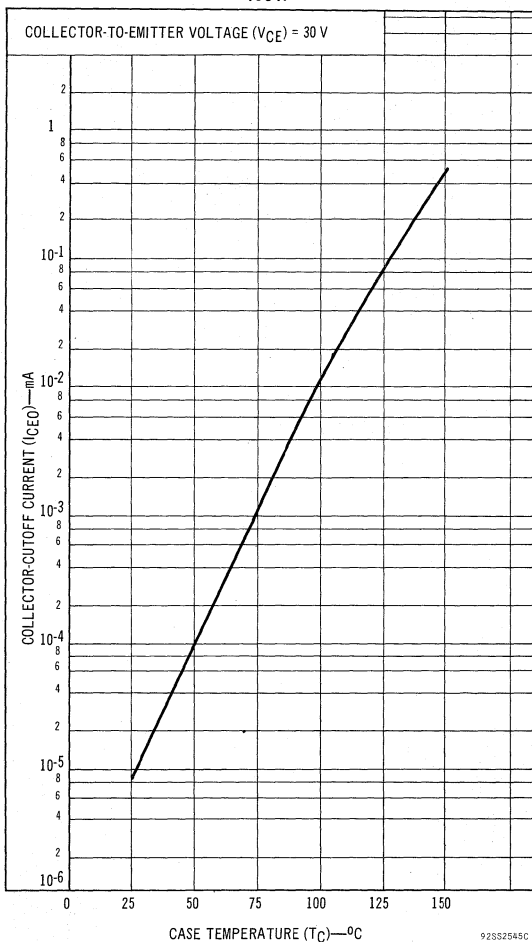


40347



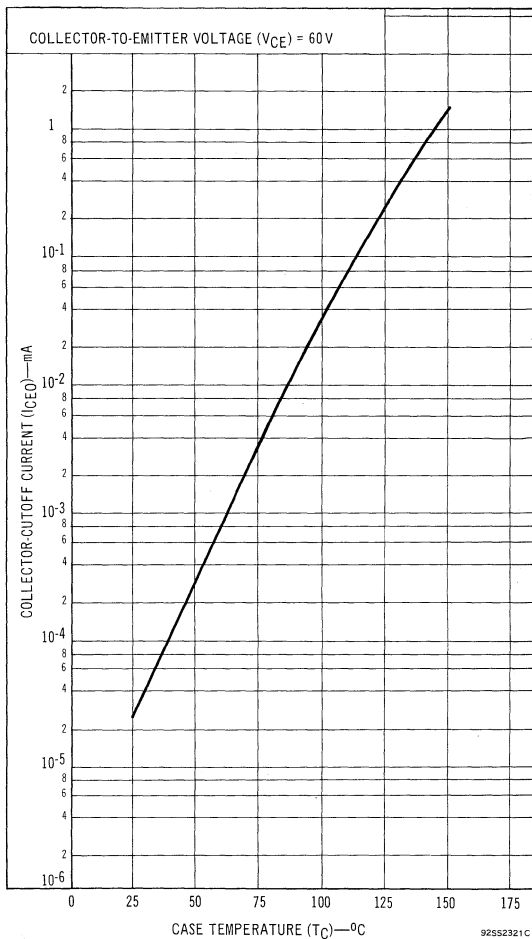
Typical Operation Characteristics

40347



Typical Operation Characteristics

40348

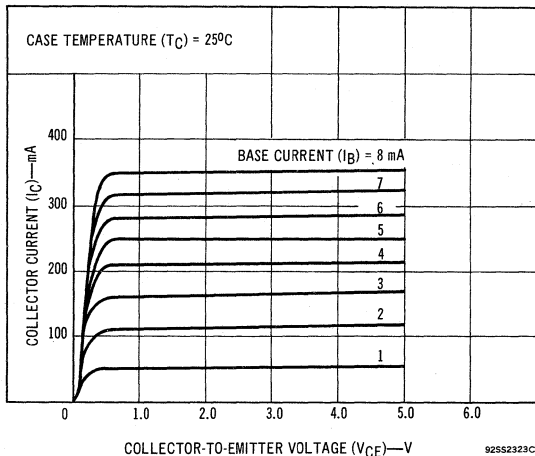


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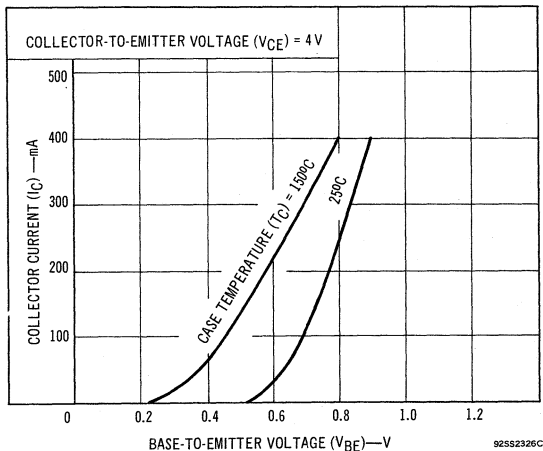
DATA 5
C-68

Typical Operation Characteristics

40348

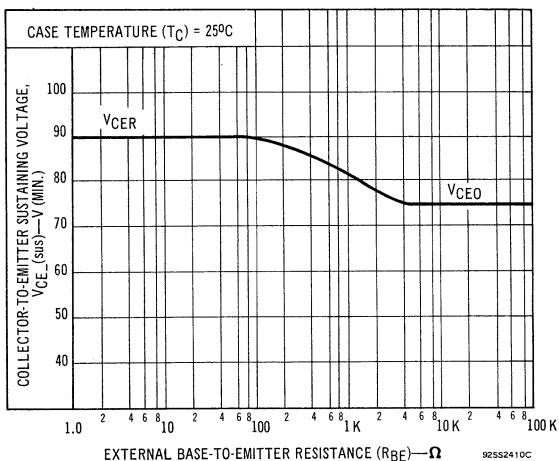


40348

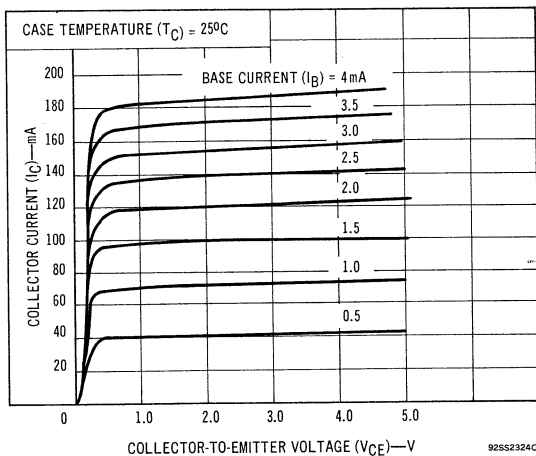


Typical Operation Characteristics

40348

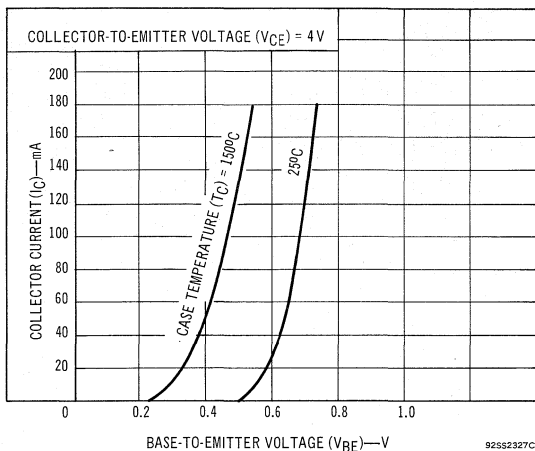


40349

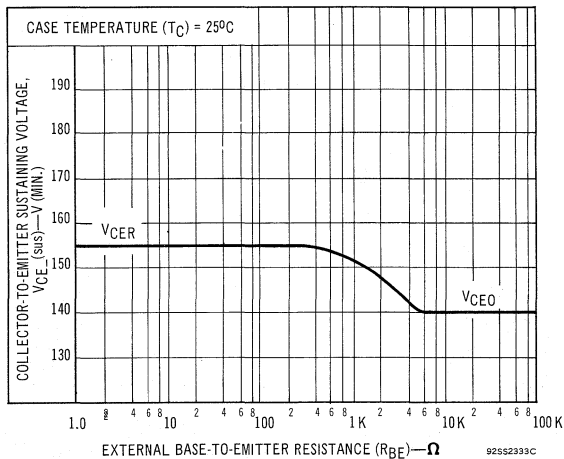


Typical Operation Characteristics

40349

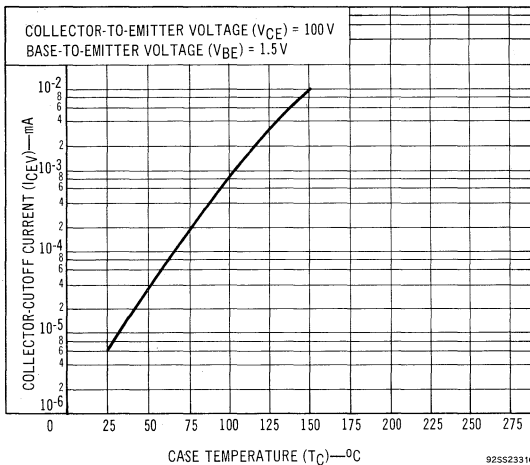


40349



Typical Operation Characteristics

40349



40354, 40355

Transistors

SILICON N-P-N TYPES

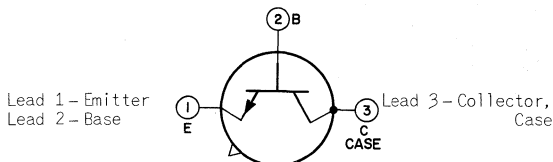
For Video-Output-Amplifier Stages of
Black-and-White TV Receivers

The 40354 and 40355 differ only in package configuration and dissipation capability.

MECHANICAL

Dimensions See accompanying *Dimensional Outline*

TERMINAL DIAGRAM (Bottom View)



ABSOLUTE-MAXIMUM RATINGS

		40354	40355	
Collector-to-Emitter Voltage . . .	V_{CE0}	150	150	V
Emitter-to-Base Voltage.	V_{EB0}	5	5	V
Collector Current.	I_C	50	50	mA
Transistor Dissipation				
At free-air temperatures:				
From -65 to 25°C	P_T	0.5	1	W
Above 25°C	Derate linearly to 0 W at 175°C			
Temperature Range				
Operating (Junction)	T_{opr}	-65 to 175		°C
Storage.	T_{stg}	-65 to 175		°C
Lead-Soldering Temperature ^a		255	255	°C
For 10 s max				

ELECTRICAL CHARACTERISTICS

Unless otherwise specified, electrode-voltage and electrode-current values for given test conditions are dc at free-air temperature = 25°C

		min	typ	max	
Collector-to-Emitter					
Breakdown Voltage . .	BV_{CE0}	150	180	-	V
$I_C = 1 \text{ mA}, I_B = 0$					
Emitter-to-Base					
Breakdown Voltage . .	BV_{EB0}	5	7	-	V
$I_E = -10 \text{ } \mu\text{A}, I_C = 0$					
Collector-to-Emitter					
Saturation Voltage. .	$V_{CE(sat)}$	-	2	5	V
$I_B = 1 \text{ mA}, I_C = 30 \text{ mA}$					
Collector-Cutoff Current	I_{CB0}	-	5	100	nA
$V_{CB} = 120 \text{ V}, I_E = 0$					



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DATA 1
2-66

40354, 40355

		<i>min</i>	<i>typ</i>	<i>max</i>
DC Forward Current				
Transfer Ratio.	h_{FE}	-	55	-
$V_{CE} = 10 \text{ V}, I_C = 10 \text{ mA}$				
Collector-to-Base				
Feedback Capacitance. . .	C_{cb}	-	2.8	3.5 pF
$V_{CE} = 10 \text{ V}, I_C = 30 \text{ mA}$				
Gain-Bandwidth Product				
$V_{CE} = 10 \text{ V}, I_C = 30 \text{ mA}$. .	f_T	50	100	- Mc/s
$V_{CE} = 140 \text{ V}, I_C = 2 \text{ mA}$. .	f_T	50	100	- Mc/s
Thermal Resistance	θ_{JC}	-	45	60 °C/W
Junction-to-case				

^a Measured along lead at distances $\geq 1/32$ inch from seating surface.

OPERATING CONSIDERATIONS

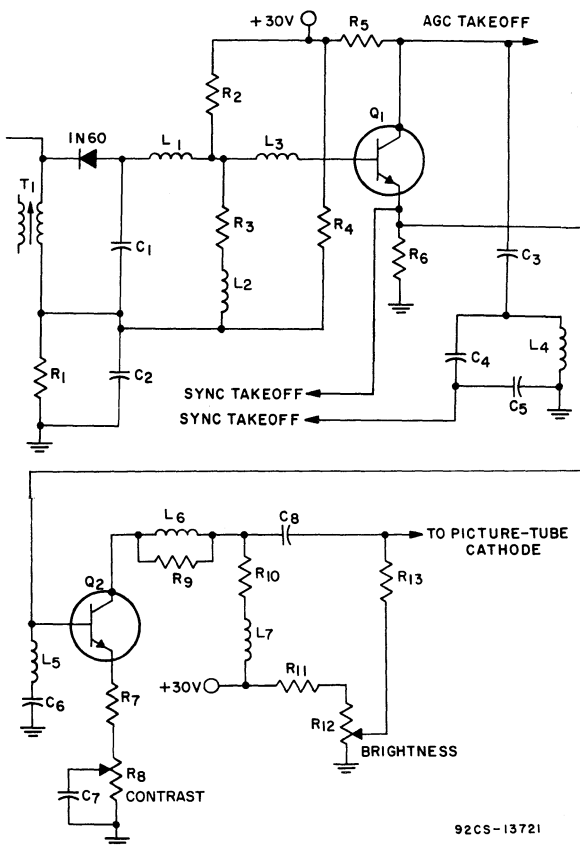
Because the metal shells of these transistors operate at the collector voltage, consideration should be given to the possibility of shock hazard if the shells are to operate at a voltage appreciably above or below ground potential. In such cases, suitable precautionary measures should be taken.

RCA-40354 and 40355 should not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistors.

These transistors can be installed in commercially available sockets. Electrical connection to the base and emitter pins may also be made by soldering directly to these pins. Such connections may be soldered to the pins close to the pin seals provided care is taken to conduct excessive heat away from the seals. Otherwise the heat of the soldering operation will crack the pin seals and damage the transistor.



TYPICAL VIDEO-AMPLIFIER CIRCUIT USING 40354



T1 - IF Transformer
 L1, L3 - 10 μ H
 L2, L6 - 220 μ H
 L4, L5 - 12.5 μ H,
 Q factor $\approx$ 75
 L7 - 100 μ H
 C1 - 8 pF

C2 - 0.005 μ F
 C3 - 22 pF
 C4, C6 - 100 pF
 C5 - 0.003 μ F
 C7 - 1000 μ F
 C8 - 0.2 μ F
 Q1 - Dev.No. TA2783

Q2 - RCA-40354 mounted on
 a heat sink having an ef-
 fective radiating area
 of 4 sq.in. (10-mil
 copper, 1" x 2")
 R1 - 330 Ω
 R2, R13 - 68 k Ω
 R3, R9 - 3.9 k Ω
 R4 - 1.2 k Ω

R5 - 1 k Ω
 R6 - 680 Ω
 R7 - 33 Ω
 R8 - Potentiometer,
 250 Ω
 R10 - 5 k Ω
 R11 - 47 k Ω
 R12 - Potentiometer,
 100 k Ω

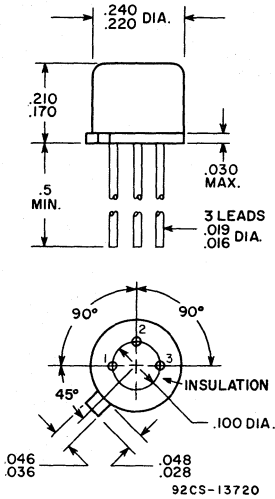


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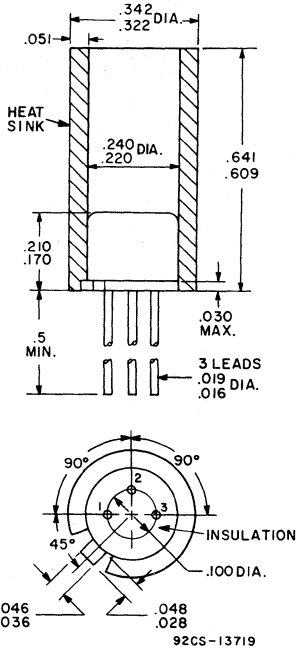
DATA 2
 2-66

DIMENSIONAL OUTLINES

40354



40355



Power Transistors

40362—P-N-P SILICON TYPE

40360 40361 40363 40364—N-P-N SILICON TYPES

For Audio Amplifier Applications Requiring High Quality Performance at Power Outputs to 35 Watts

Dimensions

40363. See Outline TO-3 in General Section
40360, 40361, 40362. See Outline TO-5 in General Section
40364. See Outline TO-66 in General Section

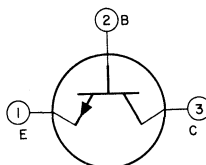
Terminal Diagrams

BOTTOM VIEW

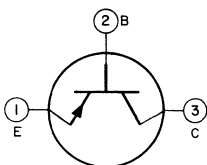
40360 40361

40362

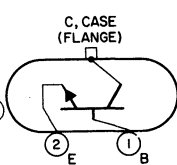
40363 40364



Lead 1—Emitter
Lead 2—Base
Lead 3—Collector



Lead 1—Emitter
Lead 2—Base
Lead 3—Collector



Pin 1—Base
Pin 2—Emitter
Mounting Flange—
Collector, Case

ABSOLUTE MAXIMUM RATINGS

	40360	40361	40362	40363	40364	
$V_{CE}(sus)$						V
$R_{BE} = 200\Omega$	-	70	-70	70	-	V
$R_{BE} = 150\Omega$	-	-	-	-	60	V
$V_{CE}(sus)$	70	-	-	-	-	V
V_{EBO}	4	4	-4	4	4	V
I_C	0.7	0.7	-0.7	15	7	A
I_B	0.2	0.2	-0.2	7	5	A
P_T						
$T_C = -65^\circ$ to $25^\circ C$	5	5	5	115	35	W
$T_C = 25^\circ$ to $200^\circ C$	Derate linearly to 0 W					
$T_{FA} = -65^\circ$ to $25^\circ C$	1	1	1	-	-	W
$T_{FA} = 25^\circ$ to $200^\circ C$	Derate linearly to 0 W					
Temperature Range						$^\circ C$
$T_{(opr)} - \text{Junction}$	← -65 to 200 →					

Definitions of symbols are given at end of data.



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DATA 1
10-65

40360 to 40364

ELECTRICAL CHARACTERISTICS

Unless otherwise specified, electrode-voltage and electrode-current values for given test conditions are dc at case temperature = 25°C

40360 40361 40362 40363 40364

Power Type:	Low		High	Intermediate			
V_{CER}(sus)							
R _{BE} = 200Ω, I _C = 100 mA	-	70	-	-	-	min	V
R _{BE} = 200Ω, I _C = -100 mA	-	-	-70	-	-	min	V
R _{BE} = 200Ω, I _C = 200 mA	-	-	-	70	-	min	V
R _{BE} = 150Ω, t _C = 200 mA	-	-	-	-	60	min	V
V_{CE0}(sus)	70	-	-	-	-	min	V
I _C = 100 mA							
V_{CE}(sat)							
I _B = 15 mA, I _C = 150 mA	1.4	1.4	-	-	-	max	V
I _B = 15 mA, I _C = -150 mA	-	-	-1.4	-	-	max	V
I _B = 400 mA, I _C = 4 A	-	-	-	1.1	-	max	V
I _B = 250 mA, I _C = 2.5 A	-	-	-	-	2	max	V
V_{BE}							
V _{CE} = 4 V, I _C = 10 mA	1	-	-	-	-	max	V
V _{CE} = 4 V, I _C = 50 mA	-	1	-	-	-	max	V
V _{CE} = -4V, I _C = -50 mA	-	-	-1	-	-	max	V
V _{CE} = 4 V, I _C = 4 A	-	-	-	1.8	-	max	V
V _{CE} = 5 V, I _C = 2.5 A	-	-	-	-	1.8	max	V
I_{CEO}							
V _{CE} = 60 V, T _C = 25°C	1	-	-	-	-	max	μA
V _{CE} = 60 V, T _C = 150°C	250	-	-	-	-	max	μA
I_{CER}							
V _{CE} = 60 V, R _{BE} = 200Ω,							
T _C = 25°C	-	1	-	500	-	max	μA
T _C = 150°C	-	100	-	2000	-	max	μA
V _{CE} = -60V, R _{BE} = 200Ω,							
T _C = 25°C	-	-	-1	-	-	max	μA
T _C = 150°C	-	-	-100	-	-	max	μA
V _{CE} = 50 V, R _{BE} = 150Ω,							
T _C = 25°C	-	-	-	-	500	max	μA
T _C = 150°C	-	-	-	-	2000	max	μA
I_{EB0}							
V _{EB} = 4 V	1	1	-	5	5	max	mA
V _{EB} = -4 V	-	-	-4	-	-	max	mA
h_{FE}							
V _{CE} = 4 V, I _C = 10 mA	{ 40	-	-	-	-	min	
	{ 200					max	
V _{CE} = 4 V, I _C = 50 mA		{ 70	-	-	-	min	
		{ 350				max	
V _{CE} = -4 V, I _C = -50 mA	-	-	{ 35	-	-	min	
			{ 200			max	
V _{CE} = 4 V, I _C = 4 A	-	-	-	{ 20	-	min	
				{ 70		max	
V _{CE} = 5 V, I _C = 0.5 A	-	-	-	-	{ 35	min	
					{ 175	max	
V _{CE} = 5 V, I _C = 2.5 A	-	-	-	-	20	min	

Definitions of symbols are given at end of data.



	40360	40361	40362	40363	40364	
Power Type:	Low			High	Intermediate	
f_T						
$V_{CE} = 4 \text{ V}, I_C = 50 \text{ mA}$	100	100	-	-	-	typ Mc/s
$V_{CE} = -4 \text{ V}, I_C = -50 \text{ mA}$	-	-	100	-	-	typ Mc/s
$V_{CE} = 4 \text{ V}, I_C = 3 \text{ A}$	-	-	-	700	-	typ kc/s
$V_{CE} = 10 \text{ V}, I_C = 2.5 \text{ A}$	-	-	-	-	15	typ Mc/s
$I_{S/b}^a$						
$V_{CE} = 40 \text{ V}$	-	-	-	-	750	min mA
θ_{JFA}	175	175	175	-	-	max $^{\circ}\text{C/W}$
θ_{JC}	35	35	35	1.5	1.5	max $^{\circ}\text{C/W}$

^a $I_{S/b}$ is defined as the current at which second breakdown occurs at a specified collector voltage, with emitter-base junction forward biased for transistor operation in the active region. For further information on S/b, consult RCA Application Notes SMA-21, "Characterization of Second Breakdown in Silicon Transistors" and SMA-30, "Second Breakdown in Transistors Under Conditions of Cutoff".

SYMBOLS AND TERMS

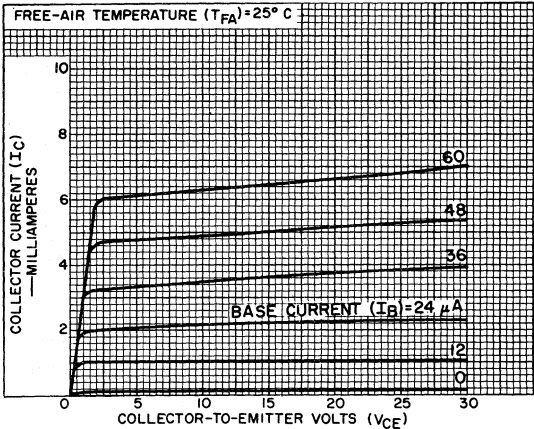
The transistor symbols are listed alphabetically with their associated terms.

f_T	Gain-bandwidth product
h_{FE}	DC forward-current transfer ratio (common-emitter circuit)
I_B	DC base current
I_C	DC collector current
I_{CEO}	DC collector-cutoff current, base open
I_{CER}	DC collector-cutoff current with specified external base-to-emitter resistance (R_{BE})
I_{EBO}	DC emitter-cutoff current, collector open
$I_{S/b}$	Collector current at which second breakdown occurs at a specified collector-to-emitter voltage
P_T	Transistor dissipation
V_{BE}	DC base-to-emitter voltage
$V_{CEO}(\text{sus})$	DC collector-to-emitter sustaining voltage, base open
$V_{CER}(\text{sus})$	DC collector-to-emitter sustaining voltage with specified external base-to-emitter resistance (R_{BE})
$V_{CE}(\text{sat})$	DC collector-to-emitter saturation voltage
V_{EBO}	DC emitter-to-base voltage, collector open
θ_{JC}	Thermal resistance, junction-to-case
θ_{JFA}	Thermal resistance, junction-to-free-air



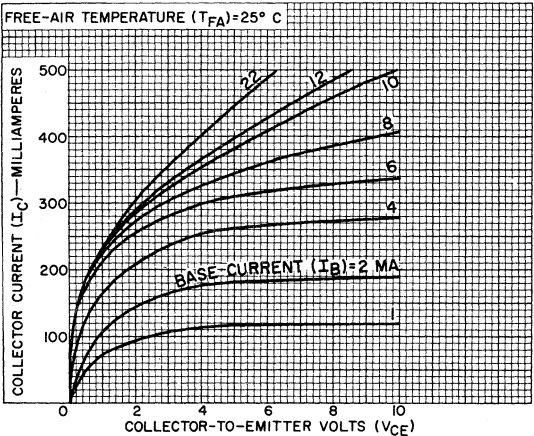
Typical Collector Characteristics

40360, 40361



92CS-13003

40360, 40361

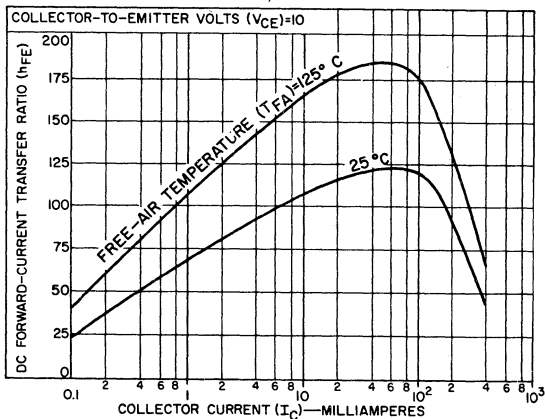


92CS-12327



Typical h_{FE} (DC Beta) Characteristics

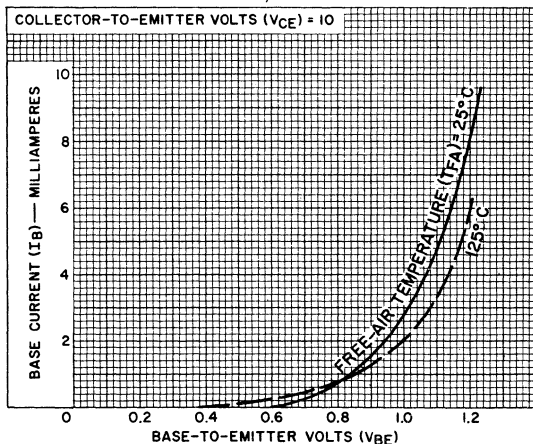
40360, 40361



92CS-12331

Typical Base (Input) Characteristics

40360, 40361



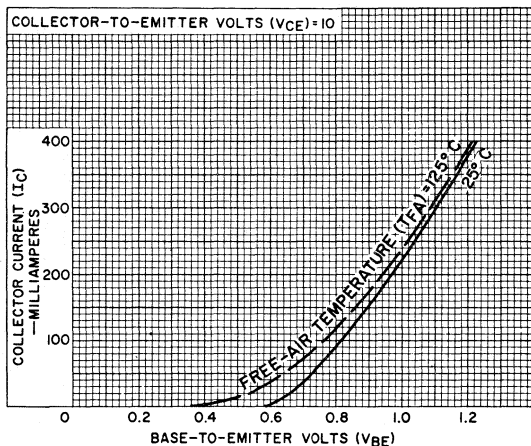
92CS-12329



40360 to 40364

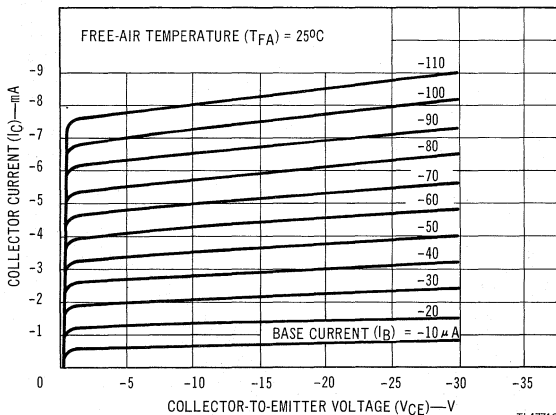
Typical Transfer Characteristics

40360, 40361



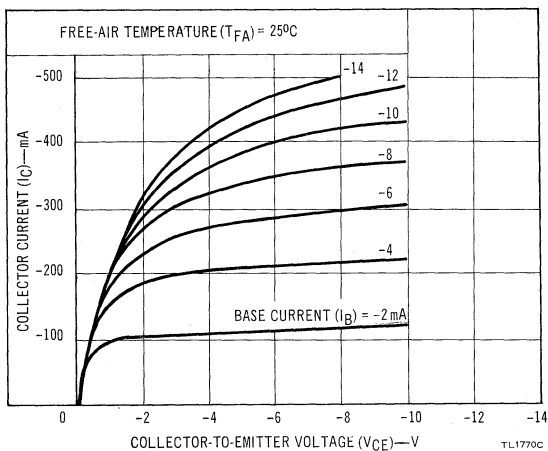
Typical Collector Characteristics

40362

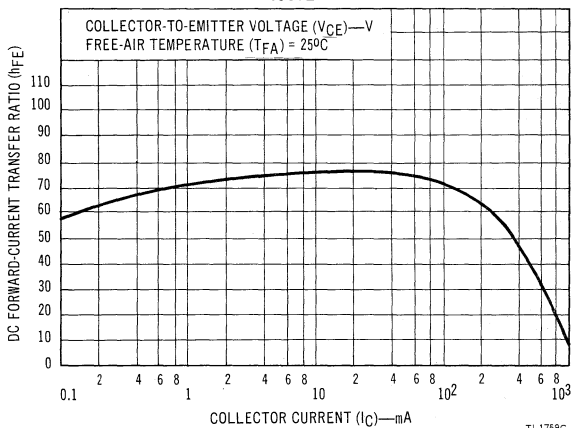


Typical Collector Characteristics

40362

Typical h_{FE} (DC Beta) Characteristics

40362



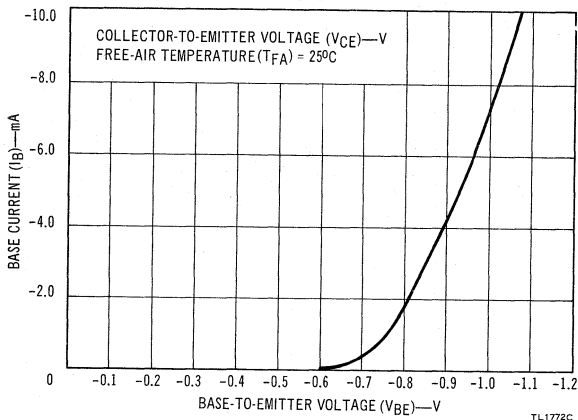
RADIO CORPORATION OF AMERICA
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DATA 4
10-65

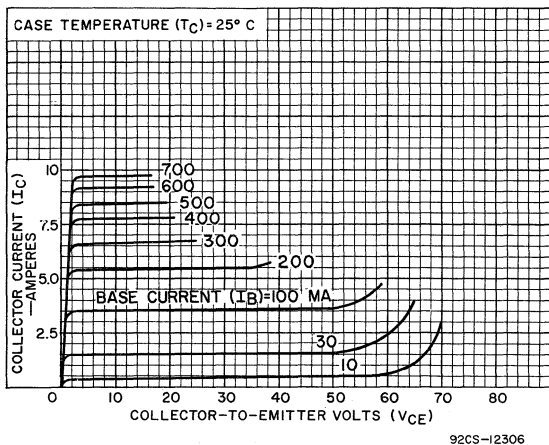
Typical Base (Input) Characteristics

40362



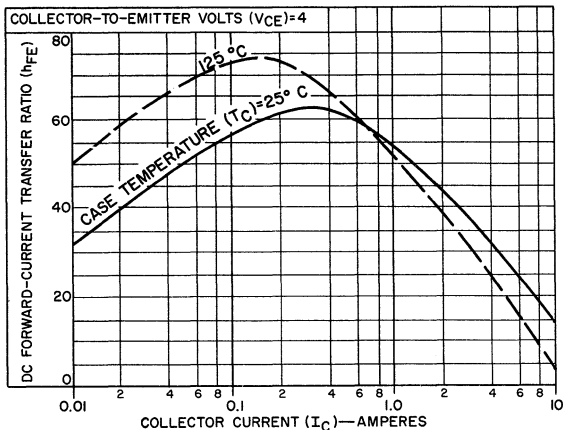
Typical Collector Characteristics

40363



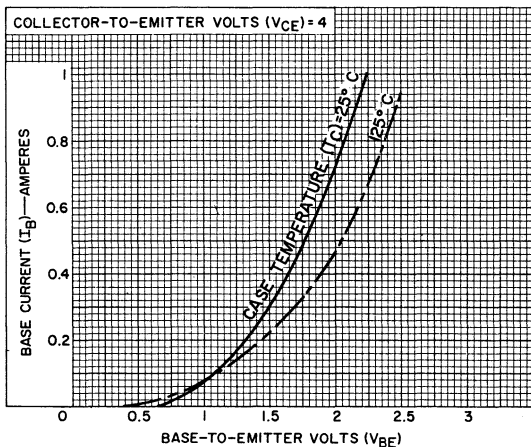
Typical h_{FE} (DC Beta) Characteristics

40363



Typical Base (Input) Characteristics

40363

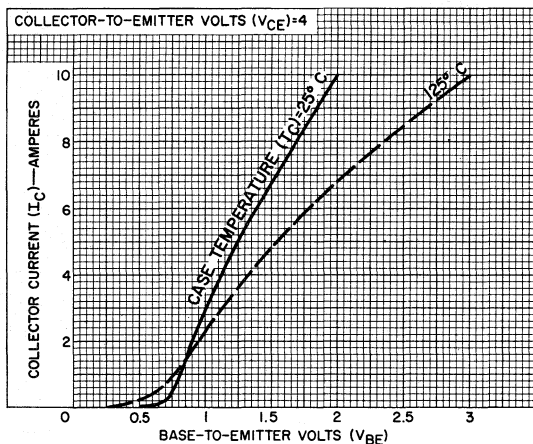


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Electronic Components and Devices Harrison, N. J.

DATA 5
10-65

Typical Transfer Characteristics

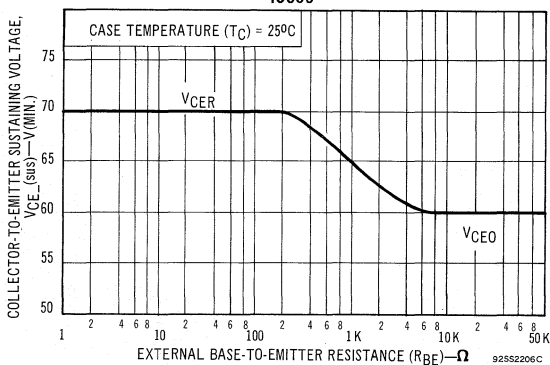
40363



92CS-12326

Typical Collector-to-Emitter
Voltage Characteristics

40363

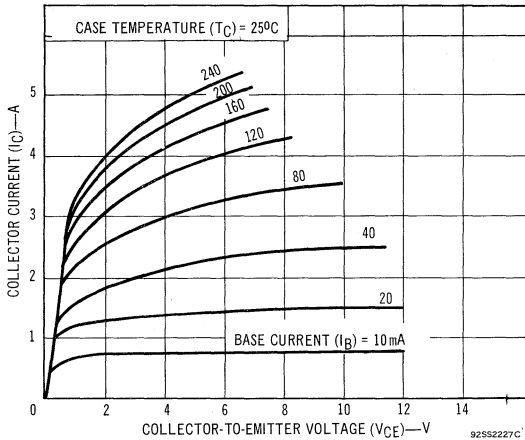


92SS2206C



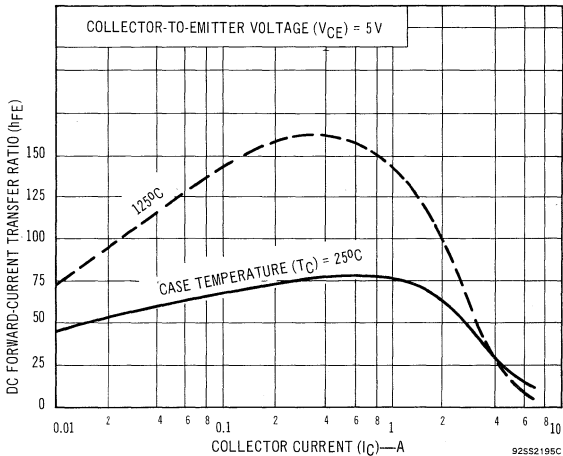
Typical Collector Characteristics

40364



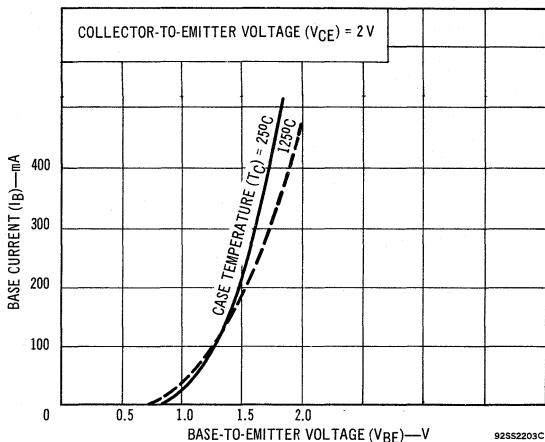
Typical h_{FE} (DC Beta) Characteristics

40364



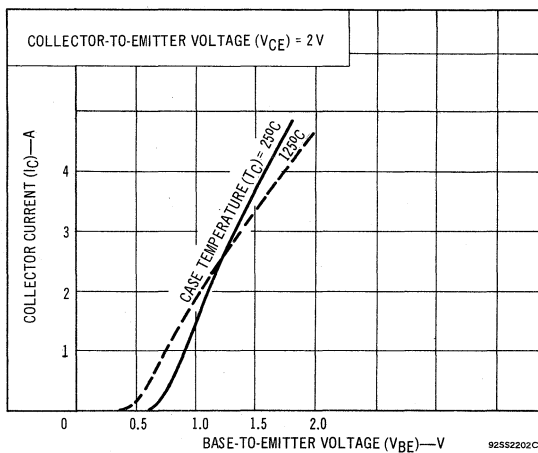
Typical Base (Input) Characteristics

40364



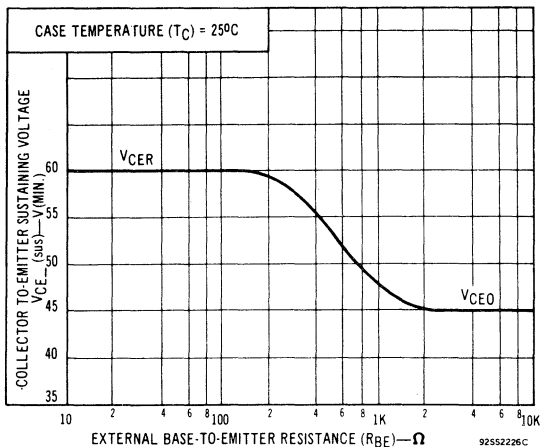
Typical Transfer Characteristics

40364



Typical Collector-to-Emitter
Voltage Characteristics

40364



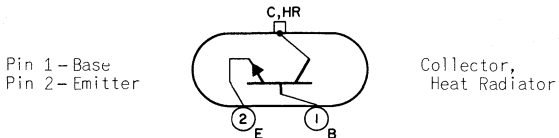
Transistor

SILICON N-P-N TRIPLE-DIFFUSED TYPE

For High-Speed Switching and Linear-Amplifier Applications such as High-Voltage Operational Amplifiers, High-Voltage Switches, Switching Regulators, Converters, Inverters, Deflection- and Hi-Fi Amplifiers, in Military, Industrial, and Commercial Equipment. Type 40374, which is a 2N3583 with Factory-Attached Heat Radiator for Increased Ambient Air Dissipation Ratings, is Intended for Printed-Circuit Board Applications.

MECHANICAL

Dimensions. See accompanying Dimensional Outline
TERMINAL DIAGRAM (Bottom View)



ABSOLUTE-MAXIMUM RATINGS

Collector-to-Base Voltage	V_{CBO}	250	V
Collector-to-Emitter Voltage.	$V_{CEO(sus)}$	175	V
Emitter-to-Base Voltage	V_{EBO}	6	V
Continuous Collector Current.	I_C	2	A
Peak Collector Current.	i_C	5	A
Continuous Base Current	I_B	1	A

Transistor Dissipation

At case temperatures. See Maximum Operating Areas
At ambient temperatures

From -65 to 25°C.	P_T	5.8	W
Above 25°C.	Derate linearly to 0 W at 200°C		

Temperature Range

Operating (Junction).	$T(opr)$	-65 to 200	°C
Storage	$T(stg)$	-65 to 200	°C
Pin-Soldering Temperature ^a		255	°C

ELECTRICAL CHARACTERISTICS

Unless otherwise specified, electrode voltage and electrode-current values for given test conditions are dc at case temperature = 25°C

Base-to-Emitter Voltage	V_{BE}	1.4 max	V
$V_{CE} = 10 \text{ V}, I_C = 1 \text{ A}$			
Collector-to-Emitter Sustaining Voltage			
$I_C = 200 \text{ mA}, I_B = 0$	$V_{CE0(sus)}$	175 ^b min	V
$R_{BE} = 50 \Omega, I_C = 200 \text{ mA}$	$V_{CER(sus)}$	250 ^b min	V



Collector-Cutoff Current

VCE = 150 V, IB = 0	ICEO	10	max	mA
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VCE = 225 V, VBE = -1.5 V	ICEV	1	max	mA
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VCE = 225 V, VBE = -1.5 V, TC = 150°C	ICEV	3	max	mA
---------------------------------------	------	---	-----	----

Emitter-Cutoff Current.	I _{EBO}	5	max	mA
--	------------------	---	-----	----

V_{EB} = 6 V, I_C = 0

Static Forward-Current**Transfer Ratio**

VCE = 10 V, I _C = 100 mA	h _{FE}	40	min	
---	-----------------	----	-----	--

VCE = 10 V, I _C = 1 A	h _{FE}	10	min	
--	-----------------	----	-----	--

Small-Signal Forward-Current

Transfer Ratio	h _{fe}	3	min	
---------------------------------	-----------------	---	-----	--

f = 5 MHz, VCE = 10 V, I_C = 200 mA

Output Capacitance.	C _{ob}	120	max	pF
--------------------------------------	-----------------	-----	-----	----

f = 1 MHz, V_{CB} = 10 V, I_E = 0

Second-Breakdown Collector Current.	I _{S/b} ^c	350	min	mA
--	-------------------------------	-----	-----	----

Base forward biased,^d

VCE = 100 V

Second-Breakdown Energy	E _{S/b} ^e	50	min	μJ
--	-------------------------------	----	-----	----

Base reverse biased,

R_{BE} = 20 Ω, L = 100 μH, VBE = -4 V

Thermal Resistance

Junction-to-air,

I _C = 500 mA	θ _{JA}	30	max	°C/W
-----------------------------------	-----------------	----	-----	------

^a Measured along pin 1/16 ± 1/32 inch from seating plane.

^b CAUTION: The sustaining voltages V_{CEO(sus)} and V_{CER(sus)} MUST NOT be measured on a curve tracer. These sustaining voltages should be measured by means of the test circuit shown in *Test Circuit Used to Measure Sustaining Voltages*.

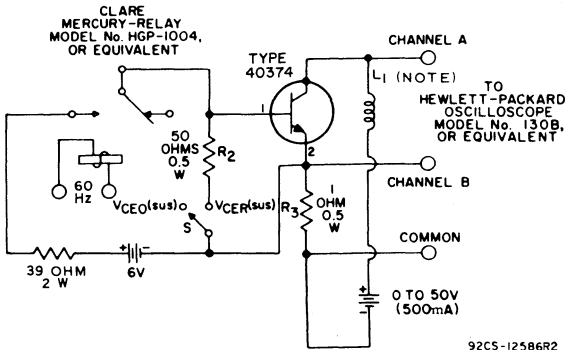
^c I_{S/b} is defined as the current at which second breakdown occurs at a specified collector voltage.

^d Specified value of I_{S/b} for given value of VCE as base voltage is increased from zero in a positive direction.

^e E_{S/b} is defined as the energy at which second breakdown occurs under specified reverse bias conditions, E_{S/b} = 1/2 LI², where L is a series load or leakage inductance and I is the peak collector current.



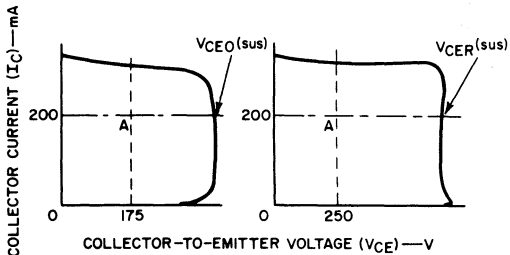
CIRCUIT USED TO MEASURE SUSTAINING VOLTAGES $V_{CE0(sus)}$ & $V_{CER(sus)}$



$L_1 = 20 \text{ mH}$ for $V_{CE0(sus)}$

$L_1 = 5 \text{ mH}$ for $V_{CER(sus)}$

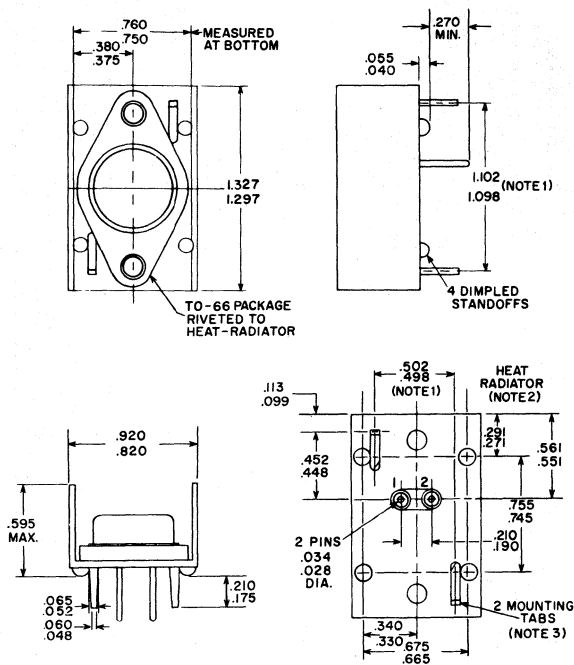
OSCILLOSCOPE DISPLAY FOR MEASUREMENT OF SUSTAINING VOLTAGES (TEST CIRCUIT SHOWN ABOVE)



Note: The sustaining voltages $V_{CE0(sus)}$ and $V_{CER(sus)}$ are acceptable when the trace falls to the right and above point "A" for type 40374.



DIMENSIONAL OUTLINE (JEDEC TO-66 WITH HEAT-RADIATOR)



92CS-13383RI

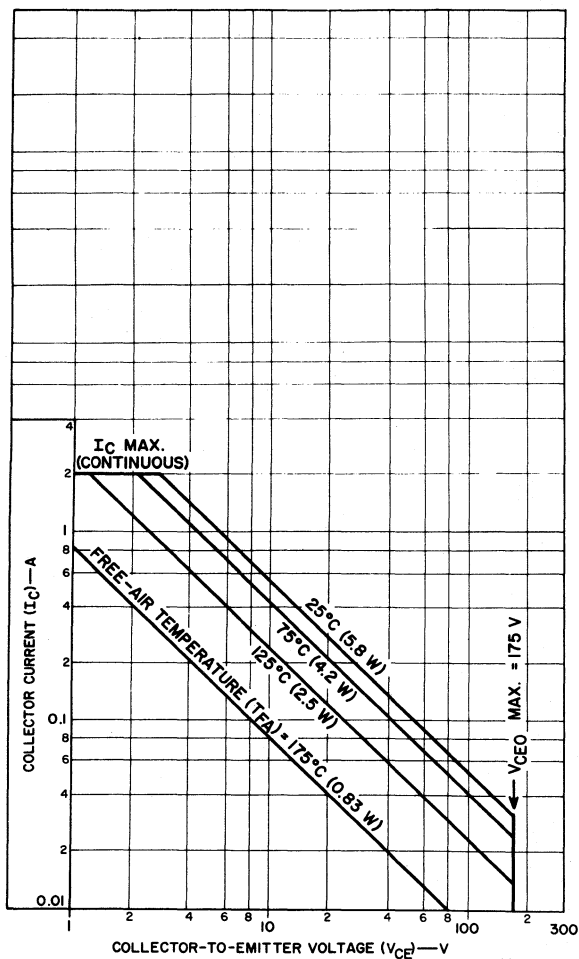
DIMENSIONS IN INCHES

Note 1: Measured at bottom of heat-radiator.

Note 2: 0.035 inch C.R.S., tin plated.

Note 3: Recommended hole size for printed-circuit board is 0.070 inch diameter.

Maximum Operating Areas



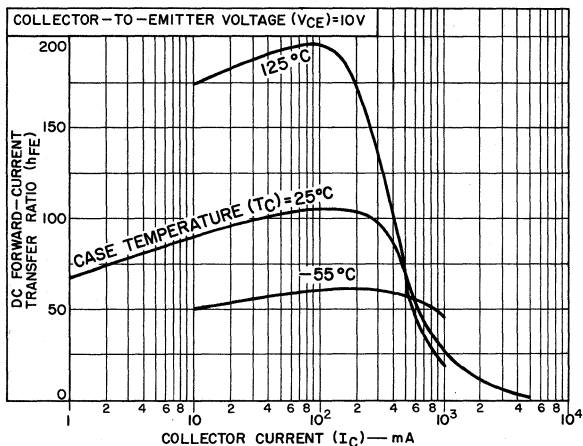
92SS-3115



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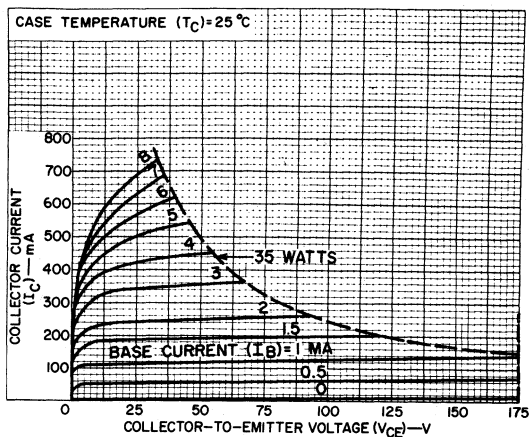
DATA 3
6-66

Typical DC Beta vs. Collector Current



92SS-3120

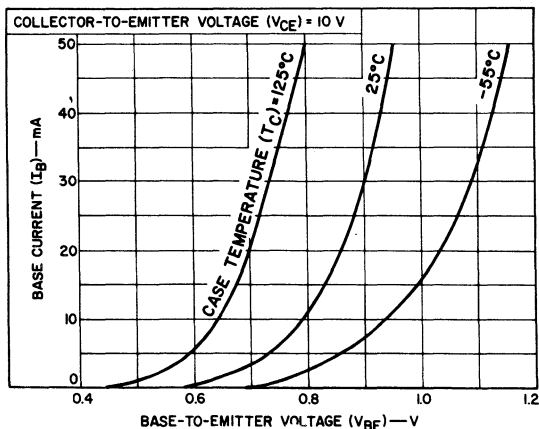
Typical Output Characteristics



92CS-12879RI



Typical Input Characteristics



92SS-3131



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Electronic Components and Devices

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DATA 4
6-66

Silicon Controlled Rectifiers

Also known as reverse-blocking triode thyristors

N-P-N-P ALL-DIFFUSED, 3-JUNCTION TYPES

*For Low-Cost Power-Control and
Power-Switching Applications*

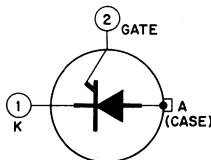
40378—For 120-Volt Line Operation

40379—For 240-Volt Line Operation

MECHANICAL

Dimensions. See accompanying *Dimensional Outline*
TERMINAL DIAGRAM (Bottom View)

Lead 1—Cathode
Lead 2—Gate



Anode—Case

The arrow indicates direction of forward current as indicated by dc ammeter

ABSOLUTE-MAXIMUM RATINGS^a

*Unless otherwise specified, for sinusoidal
ac supply voltage at a frequency between 50
and 400 c/s, with resistive or inductive load*

		40378	40379	
Peak Reverse Voltage				
Gate open:				
Repetitive.	$V_{RM(rep)}$	200	400	V
Non-repetitive (Transient) for duration of 5 ms . . .	$V_{RM(non-rep)}$	330	660	V
Peak Forward Blocking Voltage .	$V_{FBOM(rep)}$	600	600	V
Repetitive, gate open				
Average Forward Current				
T_c from -65° to 60°C :				
DC value at a conduction angle of 180°	I_{FAV}	4.5	4.5	A
RMS value	I_{FRMS}	7	7	A
For other conditions.	. See <i>Rating Chart</i> (Case Temperature)			
Peak Surge Current				
$T_c = -65^{\circ}$ to 60°C :				
1 cycle of applied voltage.	$i_{FM(surge)}$	80	80	A
More than 1 cycle of applied voltage.	$i_{FM(surge)}$	See <i>Peak-Surge</i> <i>Current Rating Chart</i>		
Peak Gate Power^b	PGM	13	13	W
Forward or reverse, for 10 μs duration	See <i>Forward and</i> <i>Reverse Gate Characteristics</i>			
Average Gate Power	PGAV	0.2	0.2	W



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DATA 1
2-66

	40378	40379
Temperature Range^c		
Operating (Case)	T(opr)	-40 to 100 °C
For rated peak forward breakover voltage ^d		100 100 °C
For rated peak reverse voltage ^d		175 175 °C
Storage	T(stg)	-40 to 125 °C

ELECTRICAL CHARACTERISTICS

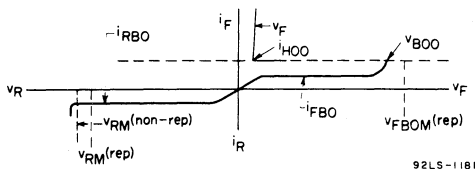
Unless otherwise specified, at maximum electrical ratings and at indicated case temperatures

	40378	40379	
Forward Breakover Voltage v_{B00}	200	400 min	V
$T_C = 100^\circ\text{C}$			
Instantaneous Forward Voltage Drop v_F	{ 1.9 2.5	1.9 typ 2.5 max	V
$T_C = 25^\circ\text{C}$, $i_F = 30\text{ A}$			
DC Gate-Trigger Voltage v_{GT}	{ 1.2 2	1.2 typ 2 max	V
Anode to cathode volts = 6, $T_C = 25^\circ\text{C}$			
Peak Blocking Current $T_C = 100^\circ\text{C}$			
Forward i_{FBOM}	{ 0.1 1	0.2 typ 2 max	mA
$V_{FB} = v_{B00}(\text{min value})$			
Reverse i_{RBOM}	{ 0.05 0.5	0.1 typ 1 max	mA
$V_{RBO} = v_{RM}(\text{rep}) \text{ value}$			
DC Gate-Trigger Current i_{GT}	{ 8 15	8 typ 15 max	mA
Anode to cathode volts = 6, $T_C = 25^\circ\text{C}$			
Holding Current i_{H00}	12	12 typ	mA
$T_C = 25^\circ\text{C}$, with gate open			
Critical Rate of Applied Forward Voltage Critical dv/dt	{ 10 200	20 typ 200 max	V/ μs V/ μs
$V_{FB} = v_{B00}(\text{min value})$, exponential rise, $T_C = 100^\circ\text{C}$. . See			Waveshape of Critical dv/dt Rating Test
Thermal Resistance θ_{JC}	5	5 max	°C/W
Junction-to-case			

- ^a Terms, Symbols, and Definitions for the data given are shown in the General Section of the Handbook.
- ^b Any values of peak gate current or peak gate voltage to give the maximum gate power is permissible.
- ^c For information on permissible soldering temperature and on the reference zone of temperature measurement, see accompanying *Cooling Considerations and Dimensional Outline*.
- ^d These devices are operated normally at a junction temperature (T_J) of up to 100°C . Occasional operation, under conditions such as overload, is permissible up to a junction temperature of 175°C ; but above 100°C , forward blocking voltage will not be maintained.



TYPICAL E-I CHARACTERISTIC OF SILICON CONTROLLED RECTIFIER



TRIGGERING CONSIDERATIONS

The construction of the gate-cathode junction used in these devices provides a large-periphery center gate. This device employs shorted-emitter design which removes restrictions on both forward and reverse peak gate voltage and peak gate current. Limiting values of volt-ampere products for different gate pulse widths are shown in *Forward Gate Characteristics*. These limits should be adhered to when pulse trigger circuits are designed for maximum trigger pulse widths and peak power dissipation. The volt-ampere products in the reverse direction shown in *Reverse Gate Characteristics* should be used to determine limitations for reverse gate transients or reverse gate pulses if present. In all cases, total average gate dissipation, both forward and reverse, should not exceed the average gate dissipation rating (P_{GAV}) of 0.2 watt.

Turn-on times for different gate currents are shown in *Turn-On Time Characteristics*. These curves may be used to determine the required width of the gate trigger pulses. It is only necessary to maintain the gate trigger pulse until the magnitude of the forward anode current has reached the latching current value. However, conservative design requires that the gate trigger pulse width be at least equal to or somewhat greater than the device turn-on time. Some applications may require wider gate pulse widths for proper circuit operation. Additional information on gate characteristics and triggering requirements for use in pulse applications are contained in RCA Application Note, SMA-39, "Gate Parameters of RCA SCR's for Trigger Circuit Design".

COOLING CONSIDERATIONS

The thermal resistance of the heat sink needed to operate these devices at a given temperature and a specific ambient air temperature, when the unit is soldered base to the heat sink, is shown in *Heat Sink Guidance Chart*. For example: at a forward current of 2 amperes and an ambient air temperature of 54.5°C (98°F), the maximum allowable thermal resistance for the required heat sink is 10°C/W . When the device is mounted in this manner, the heat sink should be in contact with at least half of the base area.

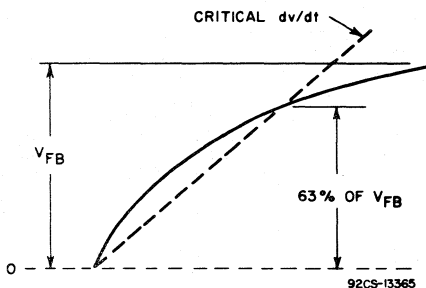
Mounting is also possible with the cap top soldered to the heat sink. However, an additional thermal resistance requirement of 8°C/W from case to heat sink is encountered. Thus,



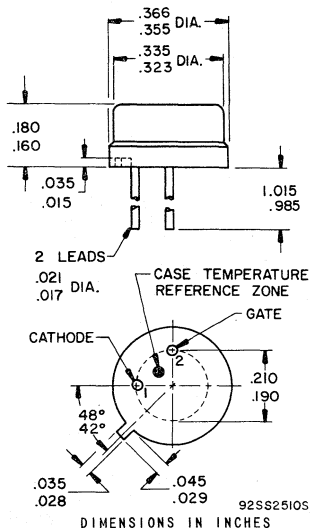
with the device mounted in this manner, and at the forward current of 2 amperes and the ambient air temperature of 54.5°C, the maximum allowable thermal resistance for the heat sink is 2°C/W.

When these devices are soldered directly to the heat sink, a 60-40 solder which has a melting point of 188°C should be used. Exposure time should only be sufficient to cause the solder to flow freely.

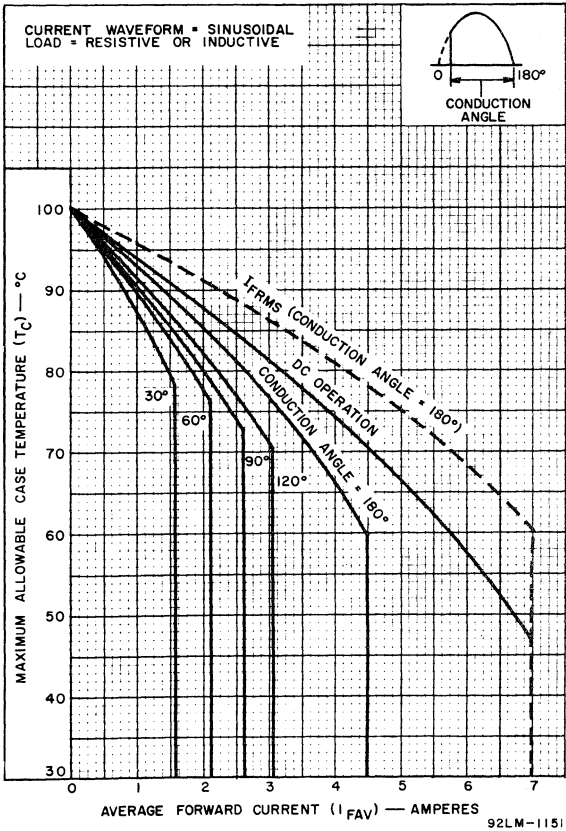
WAVESHAPE OF CRITICAL dv/dt RATING TEST



DIMENSIONAL OUTLINE



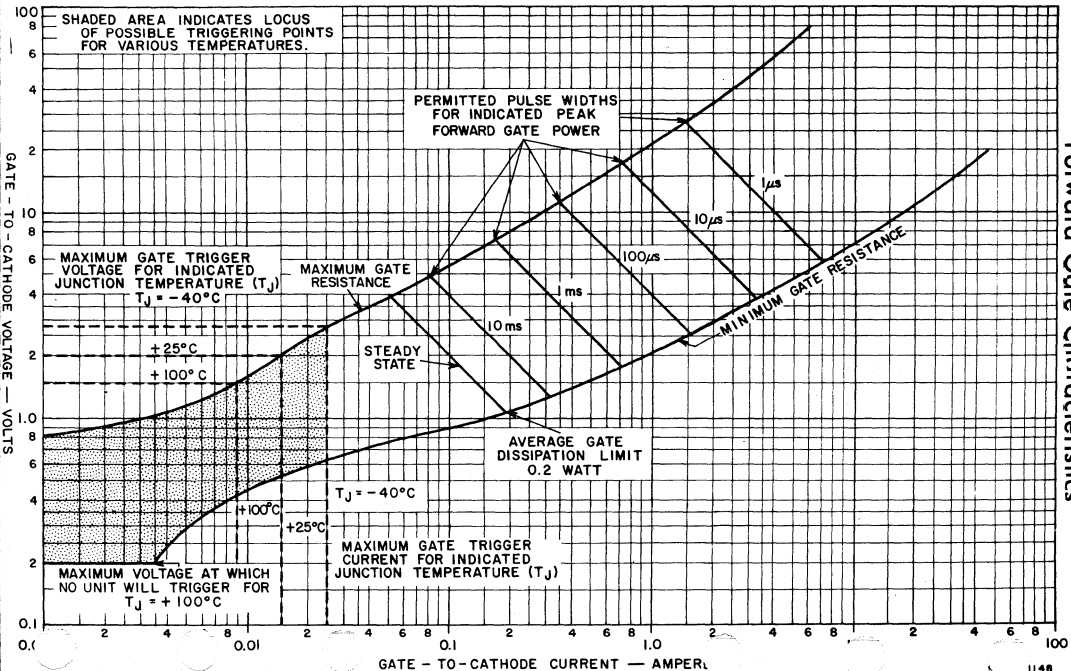
Rating Chart (Case Temperature)



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DATA IN
1-65

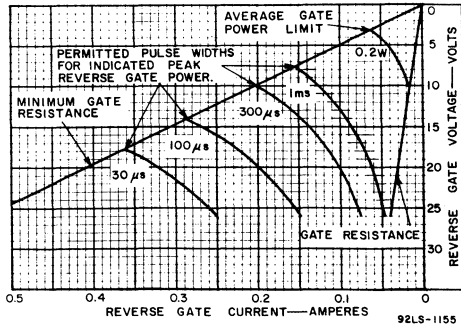
Forward Gate Characteristics



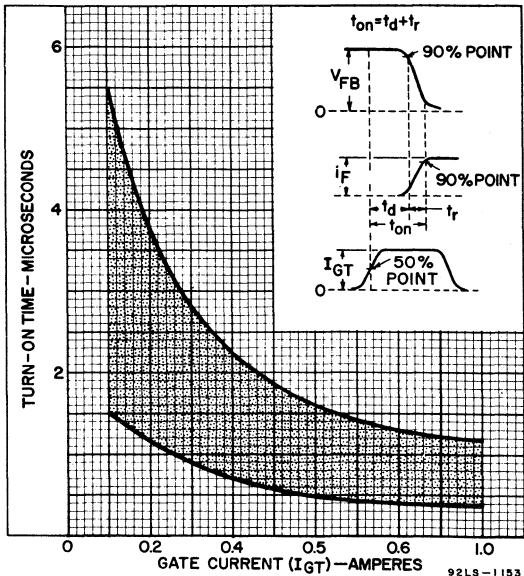
DATA 3

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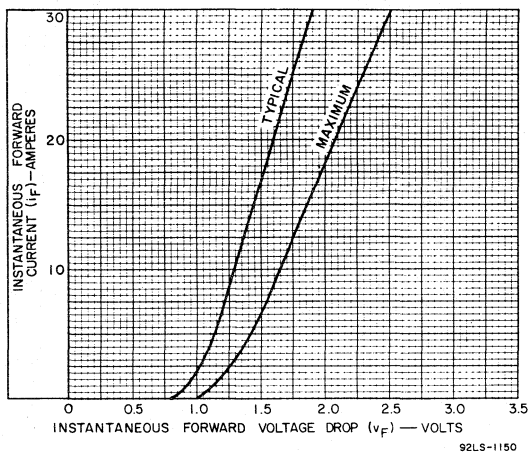
Reverse Gate Characteristics



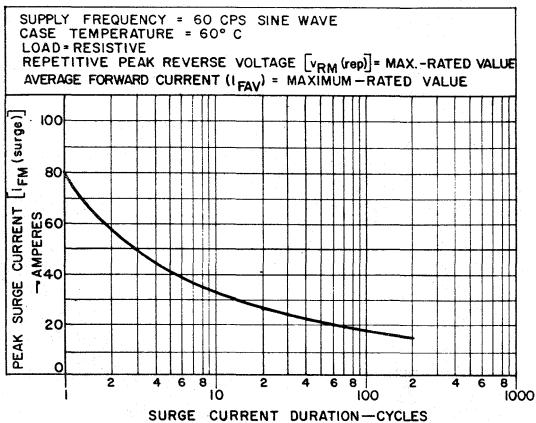
Turn-On Time Characteristics



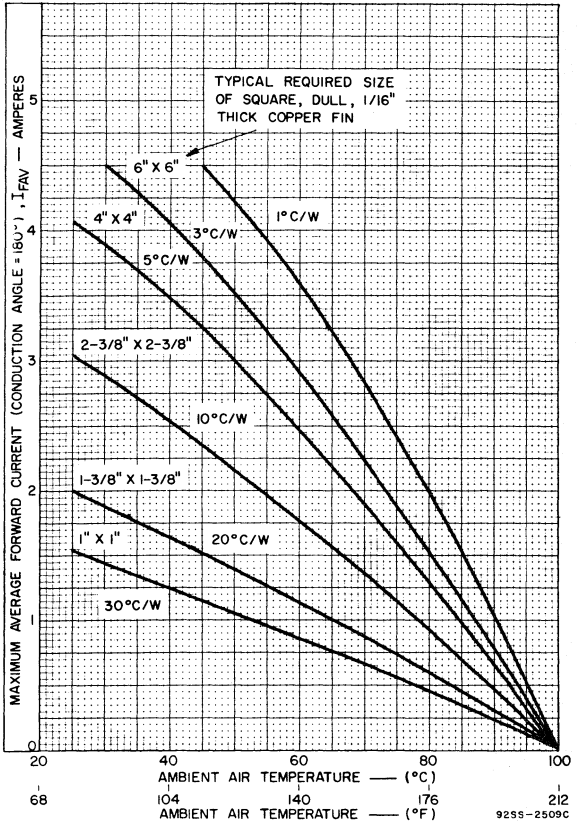
Peak-Surge Current Rating Chart



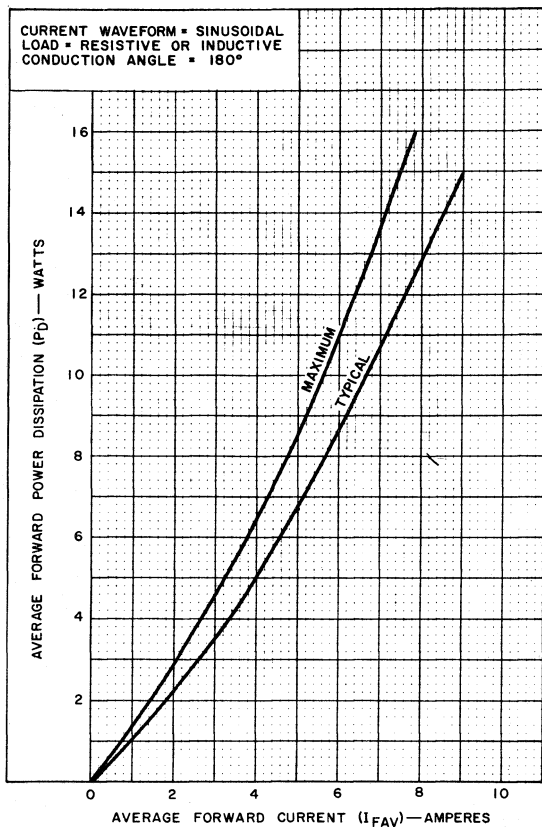
Forward Characteristics



Heat Sink Guidance Chart



Power Dissipation Chart



Transistors

40395—P-N-P GERMANIUM TYPE

40396 (MATCHED PAIR)— $\begin{cases} \text{N-P-N GERMANIUM POWER TYPE} \\ \text{P-N-P GERMANIUM POWER TYPE} \end{cases}$

Type 40395 Together With 40396 (Matched Pair) and 40234 Provide
a 4-Transistor Complement Specially Designed for 3-Stage,
1-Watt AF Amplifier Using Complementary-Symmetry Output Stages

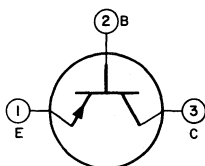
MECHANICAL

Dimensions See Outline TO-1 in General Section

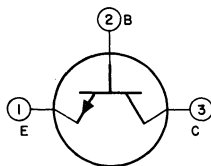
TERMINAL DIAGRAM (Bottom Views)

40395, 40396 (P-N-P Type)

40396 (N-P-N Type)



Lead 1—Emitter
Lead 2—Base
Lead 3—Collector



Lead 1—Emitter
Lead 2—Base
Lead 3—Collector

ABSOLUTE MAXIMUM RATINGS

		40395	40396 (N-P-N)	40396 (P-N-P)	
Collector-to-Base Voltage	V_{CBO}	-20	18	-18	V
Collector-to-Emitter Voltage	V_{CER}	-18	18	-18	V
$R_{BE} \leq 4.7 \text{ k}\Omega$					
Emitter-to-Base Voltage	V_{EBO}	-20	2.5	-2.5	V
Collector Current . .	I_C	-50	500	-500	mA
Transistor Dissipation					
At case temperatures: ^a					
From -65 to 55 °C	P_T	-	300	300	mW
Above 55 °C, derate linearly		-	10	10	mW/°C
At free-air temperatures:					
From -65 to 55 °C	P_T	120	-	-	mW
Above 55 °C, derate linearly		2.6	-	-	mW/°C
Temperature Range					
Operating (Junction)	$T(\text{opr})$	-65 to 100	-65 to 85		°C
Storage	$T(\text{stg})$	-65 to 100	-65 to 85		°C
Lead Temperature ^b . .		255	255	255	°C
For 10 s max					



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DATA 1
4-66

ELECTRICAL CHARACTERISTICS

Electrode-voltage and electrode-current values for given test conditions are dc at case temperature = 25 °C

40396 40396
40395 (N-P-N) (P-N-P)

Collector-to-Emitter Break-down Voltage

$R_{BE} = 10 \text{ k}\Omega$, $I_C = -1 \text{ mA}$. . .	V_{CER}	-18	-	-	min	V
$R_{BE} = 4.7 \text{ k}\Omega$, $I_C = 1 \text{ mA}$. . .	V_{CER}	-	18	-18	min	V

Collector-to-Emitter Saturation Voltage

$I_C = 250 \text{ mA}$, $I_B = 25 \text{ mA}$. . .	$V_{CE(sat)}$	{ -	0.25	-	typ	V
		{ -	0.5	-	max	V
$I_C = -250 \text{ mA}$, $I_B = -25 \text{ mA}$. .	$V_{CE(sat)}$	{ -	-	-0.25	typ	V
		{ -	-	-0.5	max	V

Collector-Cutoff Current

$V_{CB} = -20 \text{ V}$, $I_E = 0$	I_{CBO}	-12	-	-	max	μA
$V_{CB} = 12 \text{ V}$, $I_E = 0$	I_{CBO}	-	14	-14	max	μA

Emitter-Cutoff Current

$V_{EB} = 20 \text{ V}$, $I_C = 0$	I_{EBO}	-12	-	-	max	μA
$V_{EB} = 2.5 \text{ V}$, $I_C = 0$	I_{EBO}	-	14	-14	max	μA

DC Forward-Current Transfer Ratio

$V_{CE} = -1 \text{ V}$, $I_C = -50 \text{ mA}$. . .	h_{FE}	-	-	50	min	
$V_{CE} = -1 \text{ V}$, $I_C = -250 \text{ mA}$. .	h_{FE}	-	-	30	min	
$V_{CE} = 1 \text{ V}$, $I_C = 50 \text{ mA}$	h_{FE}	-	50	-	max	
$V_{CE} = 1 \text{ V}$, $I_C = 25 \text{ mA}$	h_{FE}	-	30	-	max	

Small-Signal Forward-Current Transfer Ratio

$f = 1 \text{ kc/s}$, $V_{CE} = -6 \text{ V}$, $I_C = -1 \text{ mA}$	h_{fe}	{ 170	-	-	min	
		{ 250	-	-	typ	

Small-Signal Forward-Current Transfer Ratio Cutoff Frequency

$V_{CE} = -6 \text{ V}$, $I_C = -1 \text{ mA}$. . .	f_{hfb}	10	-	1.5	typ	Mc/s
$V_{CE} = 6 \text{ V}$, $I_C = 1 \text{ mA}$	f_{hfb}	-	2	-	typ	Mc/s

Noise Current

$f = 0.05$ to 15 kc/s , $V_{CE} = -6 \text{ V}$, $I_C = -1 \text{ mA}$		{ 2	-	-	typ	nA
		{ 10	-	-	max	nA

^a Measured on case perimeter at junction with seating surface.

^b Measured along lead at distances $\geq 1/32$ inch from seating surface.



OPERATING CONSIDERATIONS

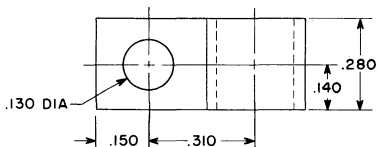
RCA-40234, 40395, and 40396 should not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistors.

The case of RCA-40234 is connected internally to the collector electrode of this transistor. Consequently, in circuits where the collector of the 40234 is operated at voltages above or below chassis or heat-sink potential, suitable precautions should be taken to prevent shock hazards and short circuits between the transistor and chassis, heat sink, and other components.

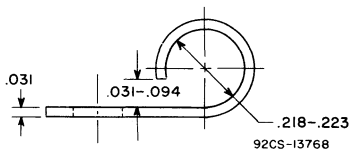
The cases of the RCA-40396 matched-pair transistors should always be fastened to an aluminum heat sink which provides an effective heat-radiating area of at least 4 square inches per transistor. The transistors should be fastened to the heat sink or chassis by clips having high thermal conductivity, such as RCA Type SA2100 shown in *Detail Drawing of RCA-SA2100 Heat-Sink Attachment Clip*.

Electrical connections to the leads of RCA-40234, 40395 and 40396 may be soldered directly to the leads, provided such connections are made at least 1/32-inch from the transistor seating surface, and provided care is taken to conduct excessive heat away from the lead seals during soldering. Failure to observe these precautions will result in cracking of the lead seals and permanent damage to the transistors.

DETAIL DRAWING OF RCA-SA2100 HEAT SINK ATTACHMENT CLIP



Material: Aluminum



DIMENSIONS IN INCHES

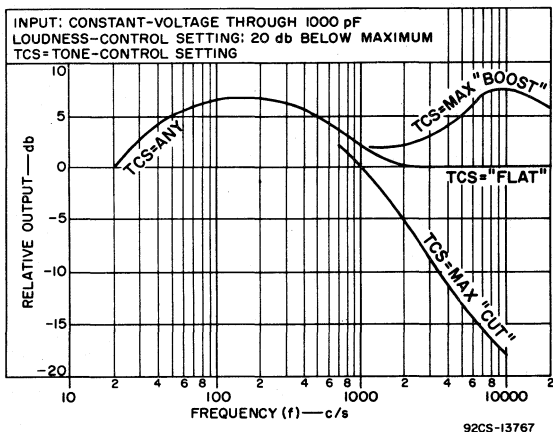


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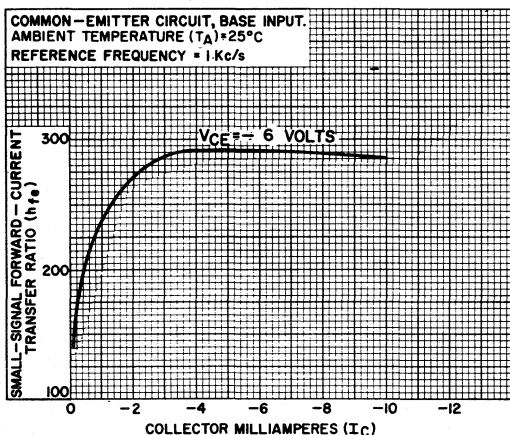
DATA 2
4-66

Frequency Response Characteristics at Reduced Loudness



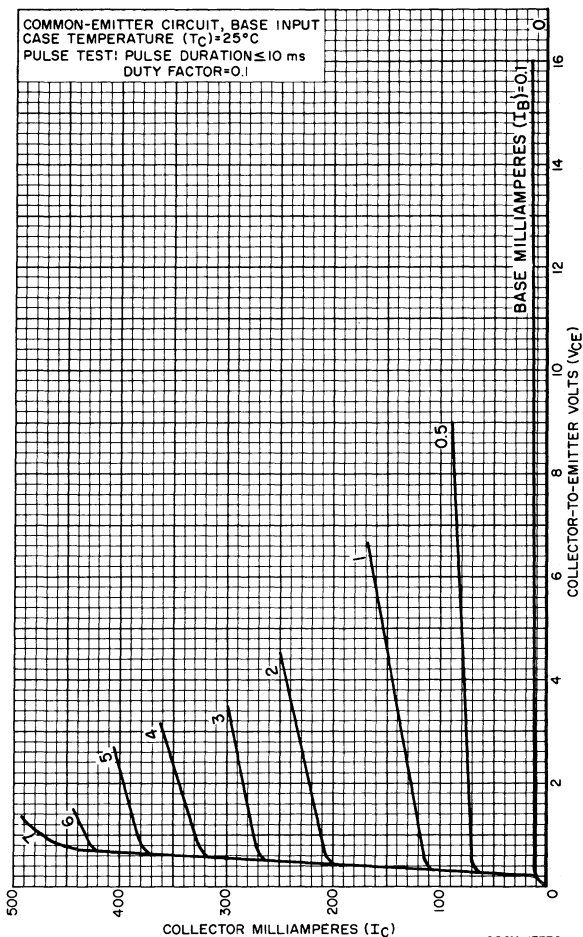
Small-Signal Beta (h_{fe}) vs. I_c

40395



Collector Characteristics (Pulse Test)

40396 (N-P-N Unit)

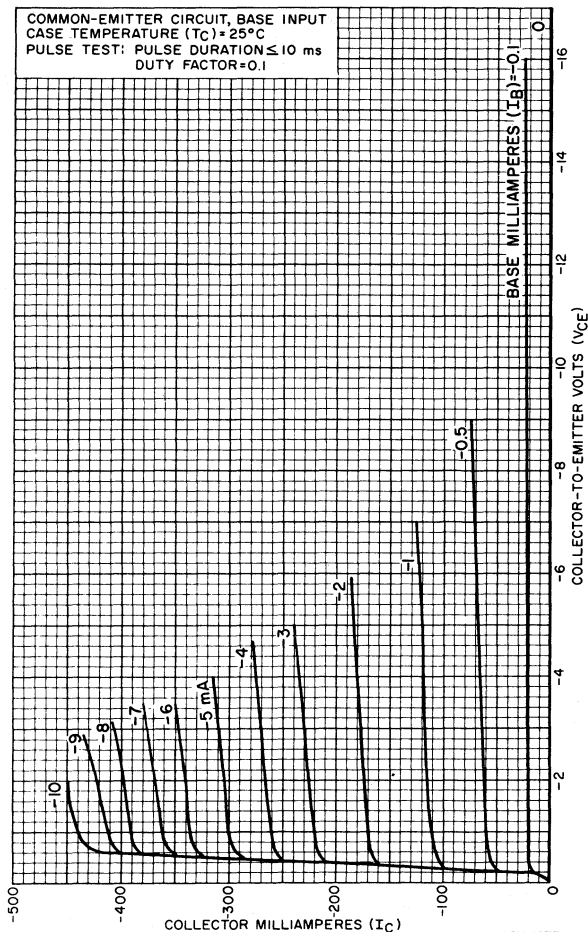


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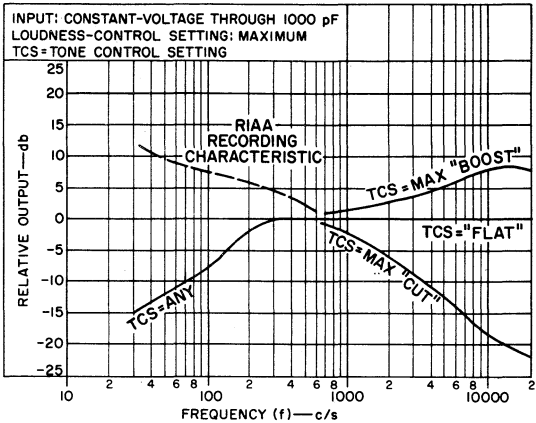
DATA 3
4-66

Collector Characteristics (Pulse Test)

40396 (P-N-P Unit)



Frequency Response Characteristics at Maximum Loudness



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DATA 4
4-66

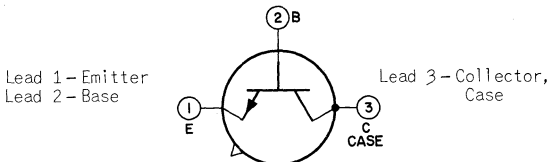
Transistor

SILICON N-P-N EPITAXIAL PLANAR TYPE

For VHF Low-Level Class C Amplifiers and Frequency-Multiplier Service in Communications Equipment

MECHANICAL

Dimensions. See Outline TO-52 in General Section
TERMINAL DIAGRAM (Bottom View)



ABSOLUTE-MAXIMUM RATINGS

Collector-to-Base Voltage	V_{CB0}	40	V
Collector-to-Emitter Voltage.	V_{CE0}	16	V
Emitter-to-Base Voltage	V_{EB0}	5	V
Collector Current	I_C	0.5	A

Transistor Dissipation

At case temperatures:

From -65 to 25°C.	P_T	1	W
Above 25°C.	Derate linearly to 0 W at 175°C		

At free-air temperatures:

From -65 to 25°C.	P_T	0.3	W
Above 25°C.	Derate linearly to 0 W at 175°C		

Temperature Range

Operating (Junction).	$T(\text{opr})$	-65 to 200	°C
Storage	$T(\text{stg})$	-65 to 175	°C
Lead-Soldering Temperature ^a		300	°C

For 10 s max

ELECTRICAL CHARACTERISTICS

Unless otherwise specified, electrode-voltage and electrode-current values for given test conditions are dc at free-air temperatures = 25°C

Collector-to-Base Breakdown Voltage	BV_{CB0}	40 min	V
$I_C = 10 \text{ mA}, I_E = 0$			
Collector-to-Emitter Breakdown Voltage ^b . .	BV_{CE0}	16 min	V
$I_C = 10 \text{ mA}, I_B = 0$			
Emitter-to-Base Breakdown Voltage	BV_{EB0}	5 min	V
$I_E = 0.01 \text{ mA}, I_C = 0$			
Collector-Cutoff Current.	I_{CB0}	25 max	nA
$V_{CB} = 20 \text{ V}, I_E = 0$			
DC Forward-Current Transfer Ratio	h_{FE}	{ 25 min 65 max }	
$V_{CE} = 2 \text{ V}, I_C = 50 \text{ mA}$			



Power Output (Frequency-Doubler)^c P_o 50 min mW

$P_i = 5$ mW, $f(in) = 43$ Mc/s,

$f(out) = 86$ Mc/s

Circuit Efficiency as a Frequency-Doubler^c. η 35 min %

$f(in) = 43$ Mc/s, $f(out) = 86$ Mc/s

Output Capacitance. C_{obo} 4 max pF

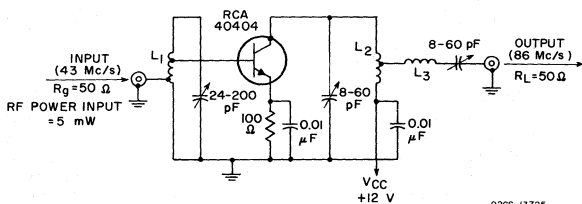
$f = 0.1$ to 1 Mc/s, $V_{CB} = 5$ V, $I_E = 0$

^a Measured along lead at distances greater than $1/16$ inch from seating surface.

^b Pulse duration ≤ 100 ns; duty factor ≤ 0.02 .

^c See accompanying Typical Frequency-Doubler Circuit.

TYPICAL FREQUENCY-DOUBLER CIRCUIT 43 to 86 Mc/s



Typical Performance Characteristics

RF Output Power	70 mW
Power Gain.	11.5 dB
Efficiency.	40 %

L_1 : 4 turns, tapped at 1 turn and 3 turns from rf-ground end

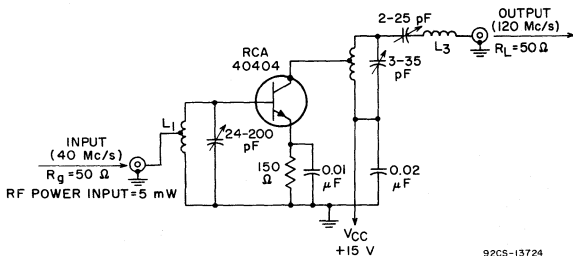
L_2 : 5 turns, tapped at 2 turns from rf-ground end

L_3 : 4-1/2 turns

All windings #16 AWG, 1/4-inch I.D., turns spaced approximately 1 wire diameter.



TYPICAL FREQUENCY-TRIPLER CIRCUIT 40 to 120 Mc/s



92CS-13724

Typical Performance Characteristics

RF Output Power (120 Mc/s)	30 mW
Power Gain	7.5 dB
Efficiency	20 %

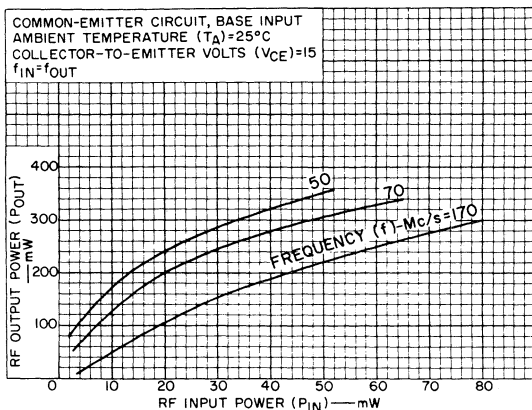
L1: 4 turns #16 AWG, 1/4-inch I.D.; tapped at 2-1/2 turns from rf-ground end

L2: 3-1/2 turns #16 AWG, 1/4-inch I.D.; tapped at 3 turns from rf-ground end

L3: 2 turns #16 AWG, 3/16-inch I.D.

Turns on all windings spaced approximately 1 wire diameter.

Output Power vs. Input Power



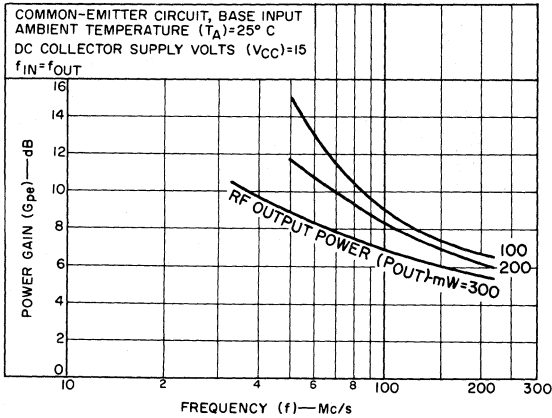
92CS-13726



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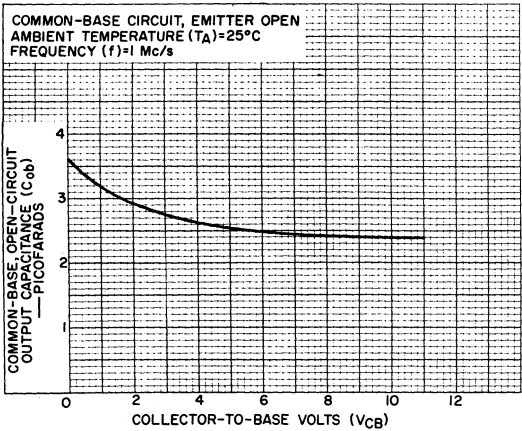
DATA 2
2-66

Power Gain vs. Frequency



92CS-13727

Output Capacitance vs. Collector-to-Base Voltage



92CS-13728



Transistor

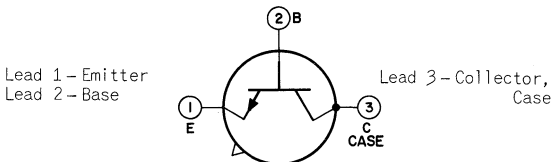
SILICON N-P-N EXPITAXIAL PLANAR TYPE

For Class C Amplifier, Driver, and Frequency-Multiplier Service
in Battery-Operated Communications Equipment

MECHANICAL

Dimensions See Outline TO-52 in General Section

TERMINAL DIAGRAM (Bottom View)



ABSOLUTE-MAXIMUM RATINGS

Collector-to-Emitter Voltage	V_{CES}	40	V
Collector-to-Emitter Voltage	V_{CEO}	16	V
Emitter-to-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	0.5	A

Transistor Dissipation

At case temperatures:

From -65 to 25°C	P_T	1	W
Above 25°C	Derate linearly to 0 W at 175°C		

At free-air temperature:

From -65 to 25°C	P_T	0.3	W
Above 25°C	Derate linearly to 0 W at 175°C		

Temperature Range

Operating (Junction)	T_{opr}	-65 to 200	°C
Storage	T_{stg}	-65 to 175	°C

Lead-Soldering Temperature ^a		300	°C
For 10 s max			

ELECTRICAL CHARACTERISTICS

Electrode-Voltage and electrode-current values for given
test conditions are dc at free-air temperature = 25°C

Collector-to-Emitter Breakdown Voltage $I_C = 5 \text{ mA}$, $V_{BE} = 0$	BV_{CES}	40 min	V
Collector-to-Emitter Breakdown Voltage ^b $I_C = 10 \text{ mA}$, $I_B = 0$	BV_{CEO}	16 min	V
Emitter-to-Base Breakdown Voltage . . . $I_E = 0.01 \text{ mA}$, $I_C = 0$	BV_{EBO}	6 min	V
Collector-Cutoff Current $V_{CE} = 15 \text{ V}$, $V_{BE} = 0$	I_{CES}	0.4 max	μA
DC Forward-Current Transfer Ratio . . . $V_{CE} = 1 \text{ V}$, $I_C = 100 \text{ mA}$	h_{FE}	20 min	
Small-Signal Forward Current-Transfer Ratio $f = 100 \text{ Mc/s}$, $V_{CE} = 1 \text{ V}$, $I_C = 100 \text{ mA}$	h_{fe}	3 min	



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DATA 1
2-66

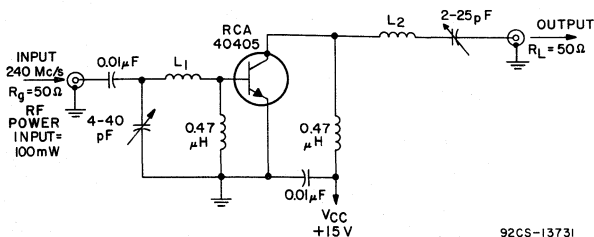
Power Output (Frequency-Doubler) ^c	P_o	200 min mW
$P_i = 30$ mW, $f(in) = 86$ Mc/s, $f(out) = 172$ Mc/s		
Circuit Efficiency as a Frequency-Doubler ^c	η	35 min %
$f(in) = 86$ Mc/s, $f(out) = 172$ Mc/s		
Output Capacitance	C_{obo}	3.5 max pF
$f = 0.1$ to 1 Mc/s, $V_{CB} = 5$ V, $I_E = 0$		

^a Measured along lead at distances greater than 1/16 inch from seating surface.

^b Pulse duration ≤ 100 μ s; duty factor ≤ 0.02 .

^c See accompanying Typical Frequency-Doubler Circuit, 88 to 172 Mc/s.

TYPICAL CLASS-C POWER-AMPLIFIER CIRCUIT 240 Mc/s



92CS-13731

L_1 : 2 turns #16 AWG, 1/8" I.D.

L_2 : 3-1/2 turns #16 AWG, 1/4" I.D.

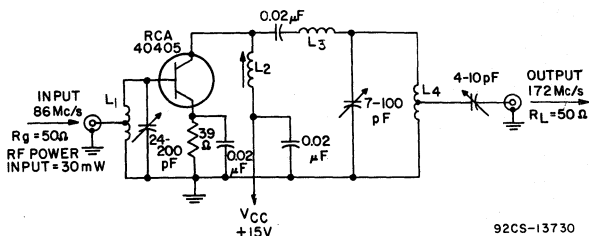
Turns spaced approximately 1 wire diameter

Typical Performance Characteristics

Operating Frequency	240 Mc/s
RF Output Power	400 mW
Power Gain	6 dB
Efficiency	50 %



TYPICAL FREQUENCY DOUBLER CIRCUIT 86 to 172 Mc/s



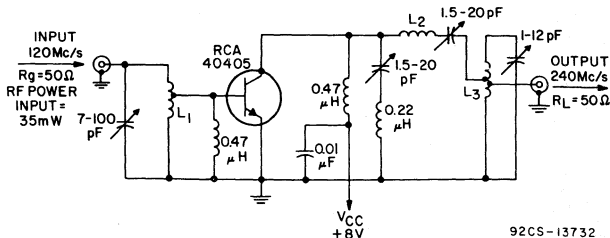
92CS-13730

- L1: 5 turns #16 AWG, tapped 3-1/2 turns from rf-ground end
 L2: 4 turns #18 AWG, slug-tuned
 L3: 6 turns #18 AWG
 L4: 3-1/2 turns #16 AWG, tapped 2-1/2 turns from rf-ground end
 All windings 1/4" I.D.; turns spaced approximately 1 wire diameter

Typical Performance Characteristics

RF Output Power (172 Mc/s)	250 mW
Power Gain	9.2 dB
Efficiency	40 %

TYPICAL FREQUENCY-DOUBLER CIRCUIT 120 to 240 Mc/s



92CS-13732

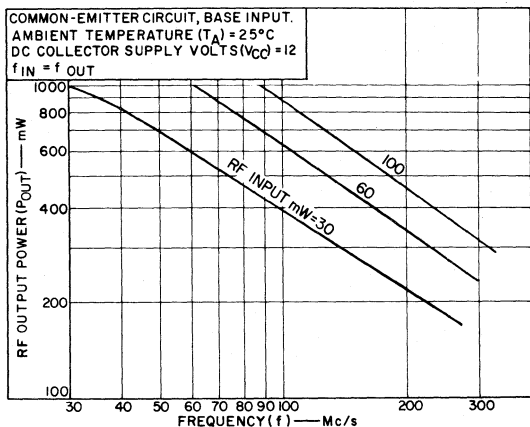
- L1: 3-1/2 turns #18 AWG, 1/4" I.D.; tapped at 2 turns from rf-ground end
 L2: 3-1/2 turns #20 AWG, 1/8" I.D.
 L3: 3 turns #16 AWG, 1/8" I.D., tapped at 1 turn and 1-1/2 turns from rf-ground end
 Turns on all windings spaced approximately 1 wire diameter

Typical Performance Characteristics

RF Power Output (240 Mc/s)	160 mW
Power Gain	6.5 dB
Efficiency	55 %

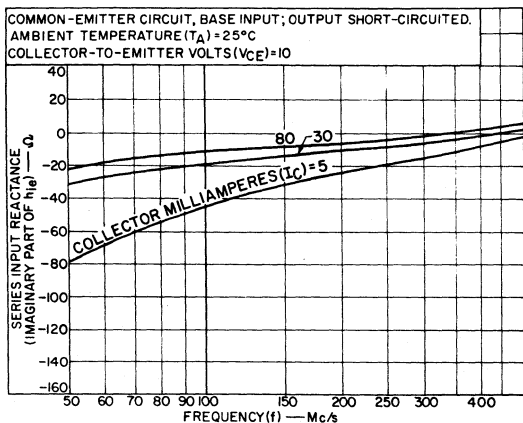


RF Output Power vs. Frequency



92CS-13733

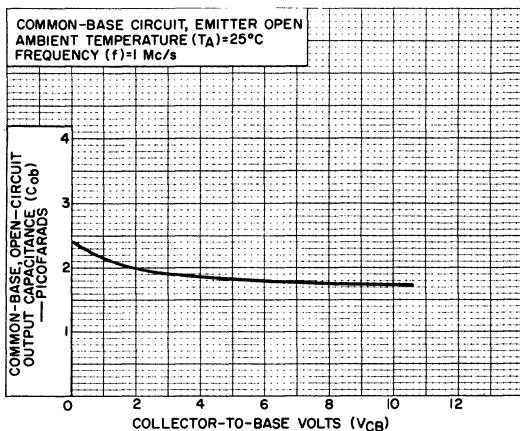
Series Input Reactance vs. Frequency



92CS-13735

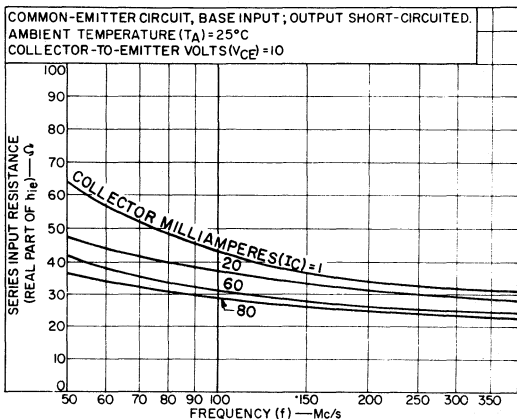


Output Capacitance vs. Collector-to-Base Voltage



92CS-13729

Series Input Resistance vs. Frequency



92CS-13736

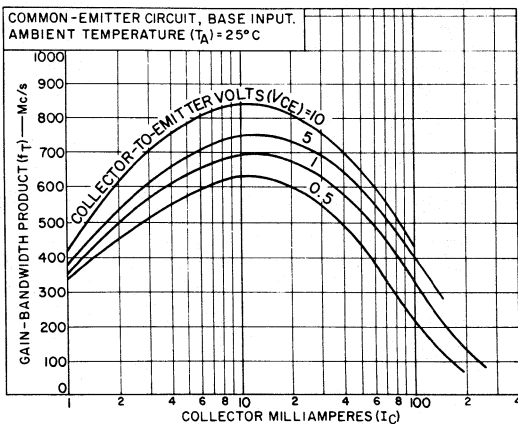


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DATA 3
2-66

Gain-Bandwidth Product vs. Collector Current



92CS-13734



40366 to 40369

Power Transistors

HIGH-RELIABILITY SILICON N-P-N TYPES

40366—TRIPLE-DIFFUSED, PLANAR TYPE

40367, 40368, 40369—HOMETAXIAL TYPES

Medium- and High-Power Switching and Amplifier Applications in Military and Industrial Equipment

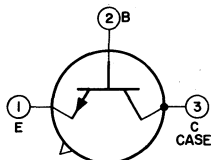
MECHANICAL

Dimensions

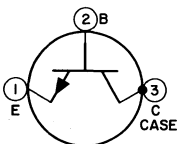
40366. See Outline TO-5 in General Section
40367. See Outline TO-5 in General Section
40368. See Outline TO-8 in General Section
40369. See Outline TO-3 in General Section

TERMINAL DIAGRAMS (Bottom Views)

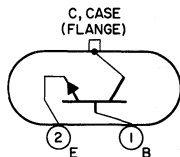
40366, 40367



40368



40369



Lead 1—Emitter

Lead 2—Base

Lead 3—Collector,
Case

Pin 1—Emitter

Pin 2—Base

Pin 3—Collector,
Case

Pin 1—Base

Pin 2—Emitter

Mounting Flange—
Collector, Case

ABSOLUTE MAXIMUM RATINGS

		40366	40367	40368	40369	
Collector-to-Base Voltage.	V_{CB0}	120	100	100	100	V
Collector-to-Emitter Voltage						
$R_{BE} \leq 10 \Omega$	V_{CER}	80	-	-	-	V
$V_{BE} = -1.5 \text{ V}$	V_{CEV}	-	100	100	100	V
Base open.	V_{CEO}	65	55	55	55	V
Emitter-to-Base Voltage.	V_{EB0}	7	12	12	10	V
Collector Current.	I_C	1	1.5	3	6	A
Base Current.	I_B	-	1	1.5	3	A
Transistor Dissipation						
At case temperatures:						
From -65 to 25°C	P_T	5	5	25	75	W
Above 25°C	Derate	linearly to 0 W at 200°C				
At free-air temperatures:						
From -65 to 25°C	P_T	1	1	-	-	W
Above 25°C	Derate	linearly to 0 W at 200°C				
Temperature Range						
Operating (Junction)	$T(\text{opr})$	$\longleftrightarrow -65$ to $200 \longrightarrow$				$^\circ\text{C}$
Storage.	$T(\text{stg})$	$\longleftrightarrow -65$ to $200 \longrightarrow$				$^\circ\text{C}$



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DATA 1
4-66

40366 to 40369

	40366	40367	40368	40369
Lead- or Pin-Soldering				
Temperature ^a	255	255	255	255 °C
For 10 s max				

ELECTRICAL CHARACTERISTICS

Electrode-voltage and electrode-current values for given test conditions are dc at case temperature = 25 °C

	40366	40367	40368	40369
Collector-to-Base Breakdown Voltage	BV_{CBV}	120	-	- min V
$V_{EB} = 1.5 \text{ V}, I_C = 0.1 \text{ mA}$				
Collector-to-Emitter Breakdown Voltage	BV_{CEV}	-	100	100 min V
$V_{EB} = 1.5 \text{ V}, I_C = 0.25 \text{ mA}$				
Emitter-to-Base Breakdown Voltage	BV_{EB0}	7	-	- min V
$I_E = 0.1 \text{ mA}, I_C = 0$				
Collector-to-Emitter Sustaining Voltage				
I_C (Pulsed) = 100 mA ^b , $R_{BE} = 10 \Omega$	$V_{CER(sus)}$	80	-	- min V
Base open, $I_B = 0$:				
$I_C = 50 \text{ mA}$	$V_{CEO(sus)}$	-	55	- min V
I_C (Pulsed) = 100 mA ^b	$V_{CEO(sus)}$	65	-	- min V
$I_C = 100 \text{ mA}$	$V_{CEO(sus)}$	-	-	55 min V
Collector-to-Emitter Saturation Voltage				
I_C (Pulsed) = 150 mA ^b , $I_B = 15 \text{ mA}$	$V_{CE(sat)}$	0.5	-	- max V
$I_C = 200 \text{ mA}, I_B = 10 \text{ mA}$	$V_{CE(sat)}$	-	1.4	- max V
$I_C = 750 \text{ mA}, I_B = 40 \text{ mA}$	$V_{CE(sat)}$	-	-	0.75 max V
$I_C = 1300 \text{ mA}, I_B = 100 \text{ mA}$	$V_{CE(sat)}$	-	-	- max V
Base-to-Emitter Saturation Voltage	$V_{BE(sat)}$	1.1	-	- max V
I_C (Pulsed) = 150 mA ^b , $I_B = 15 \text{ mA}$				
Base-to-Emitter Voltage				
$V_{CE} = 4 \text{ V}, I_C = 200$	V_{BE}	-	3	- max V
$V_{CE} = 4 \text{ V}, I_C = 750$	V_{BE}	-	-	2.5 max V
$V_{CE} = 4 \text{ V}, I_C = 1500$	V_{BE}	-	-	- 2.5 max V
Collector-Cutoff Current				
$V_{CB} = 30, I_E = 0$	I_{CBO}	-	4	9 max μA
$V_{CB} = 60, I_E = 0$	I_{CBO}	2	-	- nA
Emitter-Cutoff Current				
$V_{EB} = 5 \text{ V}, I_C = 0$	I_{EBO}	5	-	- max nA
$V_{EB} = 10 \text{ V}, I_C = 0$	I_{EBO}	-	-	- 6 max μA
$V_{EB} = 12 \text{ V}, I_C = 0$	I_{EBO}	-	2	5 max μA



40366 40367 40368 40369

DC Forward-Current
Transfer Ratio

$V_{CE} = 4, I_C = 200 \text{ mA}$	h_{FE}	-	$\begin{cases} 35 \\ 100 \end{cases}$	-	-	min max
$V_{CE} = 4, I_C = 750 \text{ mA}$	h_{FE}	-	-	$\begin{cases} 35 \\ 100 \end{cases}$	-	min max
$V_{CE} = 4, I_C = 1500 \text{ mA}$	h_{FE}	-	-	-	$\begin{cases} 25 \\ 75 \end{cases}$	min max
$V_{CE} = 10, I_C = 0.01 \text{ mA}$	h_{FE}	10	-	-	-	min
$V_{CE} = 10, I_C = 0.1 \text{ mA}$	h_{FE}	20	-	-	-	min
$V_{CE} = 10, I_C \text{ (Pulsed)} =$ 150 mA^b	h_{FE}	$\begin{cases} 40 \\ 120 \end{cases}$	-	-	-	min max
$V_{CE} = 10, I_C \text{ (Pulsed)} =$ 0.5 A^b	h_{FE}	25	-	-	-	min
$V_{CE} = 10, I_C \text{ (Pulsed)} =$ 1 A^b	h_{FE}	10	-	-	-	min

^a Measured along lead or pin distances $\geq 1/32$ inch from seating plane.^b Pulse duration = 300 μs , duty factor = .018.

All Characteristics Curves

indicated for types 2N2102, 2N1482, 2N1486, and 2N1490
also apply to the 40366, 40367, 40368, and 40369 respectively

RELIABILITY TESTING

Each RCA-40366, 40367, 40368, and 40369 is subjected to the
following preconditioning steps:

1. Temperature Cycling-Method 102A of MIL-STD-202, 5 cycles, -65 °C to 200 °C
2. Bake, 72 hours min., 200 °C
3. Helium Leak, 1×10^{-8} cc/s max.
4. (a) Methanol Bomb, 70 psig, 16 hours min. (For 40366)
(b) Bubble Test (Per MIL-STD-202, COND. A), 125 °C min., 1 minute, ethylene glycol (For 40367, 40368, & 40369)
5. Serialization
6. (a) Record I_{CBO} and h_{FE} (150 mA) (40366)
(b) Record I_{CBO} and h_{FE} (For 40367, 40368, & 40369)
7. (a) Power Age, $T_A = 25$ °C, $V_{CB} = 60 \text{ V}$, $t = 168$ hours, $P_T = 1 \text{ W}$, free-air (For 40366 & 40367)
(b) Power Age, $T_C = 125$ °C, $V_{CB} = 24 \text{ V}$, $t = 168$ hours, $P_T = 10.5 \text{ W}$, with heat-sink (For 40368)
 $P_T = 32 \text{ W}$, with heat-sink (For 40369)
8. (a) For 40366, record I_{CBO} , h_{FE} (150 mA), BV_{CBV} , $V_{CE0}(\text{sus})$, BV_{EBO} , $V_{CE}(\text{sat})$. Data furnished with transistor.
(b) For 40367, 40368, & 40369, record I_{CBO} , h_{FE} , BV_{CEV} , $V_{CE0}(\text{sus})$, I_{EBO} , $V_{CE}(\text{sat})$. Data furnished with transistors.

^c Delta criteria after 168 hours Power Age: $\Delta h_{FE} \pm 25\%$ (For all types) $\Delta I_{CBO} + 1 \mu\text{A}$ (For 40367, 40368, & 40369)RADIO CORPORATION OF AMERICA
Electronic Components and Devices
Harrison, N. J.DATA 2
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40366 to 40369

Group A Test (In Accordance with MIL-S-19500)

TEST METHOD^d EXAMINATION OR TEST & CONDITIONS 40366 40367 40368 40369

Subgroup 1 — LTPD^e-10

2071 Visual and Mechanical Examination

Subgroup 2 — LTPD-5

3036D	I_{CB0}				
	$V_{CB} = 30 \text{ V}, I_E = 0$	-	4	9	10 max μA
	$V_{CB} = 60 \text{ V}, I_E = 0$	2	-	-	- max nA
3061D	I_{EB0}				
	$V_{EB} = 5 \text{ V}, I_C = 0$	5	-	-	- max nA
	$V_{EB} = 10 \text{ V}, I_C = 0$	-	-	-	6 max μA
	$V_{EB} = 12 \text{ V}, I_C = 0$	-	2	5	- max μA
3001A	BV_{CBV}	120	-	-	- min V
	$I_E = 100 \mu\text{A}, V_{EB} = 1.5 \text{ V}$				
3026D	BV_{EBO}	7	-	-	- min V
	$I_E = 100 \mu\text{A}, I_C = 0$				
3011A	$BV_{CEV}(\text{sus})$				
	$I_C = 0.25 \text{ mA}, V_{EB} = 1.5 \text{ V}$. . .	-	100	100	- min V
	$I_C = 0.5 \text{ mA}, V_{EB} = 1.5 \text{ V}$. . .	-	-	-	100 min V
3011D	$V_{CE0}(\text{sus})$				
	$I_C = 50 \text{ mA}, I_B = 0$	-	55	-	- min V
	$I_C (\text{Pulsed}) = 100 \text{ mA}^b, I_B = 0$. .	65	-	-	- min V
	$I_C = 100 \text{ mA}, I_B = 0$	-	-	55	55 min V
3011B	$V_{CER}(\text{sus})$				
	$I_C (\text{Pulsed}) = 100 \text{ mA}^c, R_{BE} = 10 \Omega$				
Subgroup 3 — LTPD-5					
3071	$V_{CE}(\text{sat})$				
	$I_C (\text{Pulsed}) = 150 \text{ mA}^b, I_B = 15 \text{ mA}$	0.5	-	-	- max V
	$I_C = 200 \text{ mA}, I_B = 10 \text{ mA}$	-	1.4	-	- max V
	$I_C = 750 \text{ mA}, I_B = 40 \text{ mA}$	-	-	0.75	- max V
	$I_C = 1.5 \text{ A}, I_B = 100 \text{ mA}$	-	-	-	1 max V
3066A	$V_{BE}(\text{sat})$				
	$I_C (\text{Pulsed}) = 150 \text{ mA}^b, I_B = 15 \text{ mA}$	1.1	-	-	- max V
	V_{BE}				
	$I_C = 200 \text{ mA}, V_{CE} = 4 \text{ V}$	-	3	-	- max V
	$I_C = 750 \text{ mA}, V_{CE} = 4 \text{ V}$	-	-	2.5	- max V
3076	h_{FE}				
	$I_C = 0.01 \text{ mA}, V_{CE} = 10 \text{ V}$	10	-	-	- min
	$I_C = 0.1 \text{ mA}, V_{CE} = 10 \text{ V}$	20	-	-	- min
	$I_C (\text{Pulsed}) = 150 \text{ mA}^b, V_{CE} = 10 \text{ V}$	40	-	-	- min
		120	-	-	- max
	$I_C = 200 \text{ mA}, V_{CE} = 4 \text{ V}$	-	35	-	- min
		-	100	-	- max
	$I_C (\text{Pulsed}) = 500 \text{ mA}^b, V_{CE} = 10 \text{ V}$	25	-	-	- min
	$I_C = 750 \text{ mA}, V_{CE} = 4 \text{ V}$	-	-	35	- min
		-	-	100	- max
	$I_C (\text{Pulsed}) = 1 \text{ A}^b, V_{CE} = 10 \text{ V}$.	10	-	-	- min
	$I_C = 1.5 \text{ A}, V_{CE} = 4 \text{ V}$	-	-	-	25 min
		-	-	-	75 max

^d Per Mil-Std-750.

^e Lot tolerance per cent defective.



Power Transistor

SILICON N-P-N EPITAXIAL TYPE

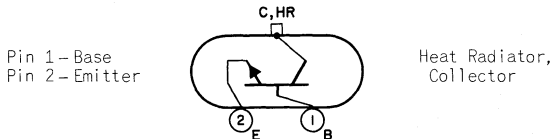
Type 40375 is a 2N3878 Factory-Attached on a Heat Radiator for Free-Air Operation and is Intended for Those Applications Which Require a Power Transistor for Mounting on a Printed-Circuit Board

The 40375 is same as the 2N3878 except for the following items:

MECHANICAL

Dimensions See accompanying Dimensional Outline

TERMINAL DIAGRAM (BOTTOM VIEW)



ABSOLUTE-MAXIMUM RATINGS

Transistor Dissipation

At free-air temperatures:

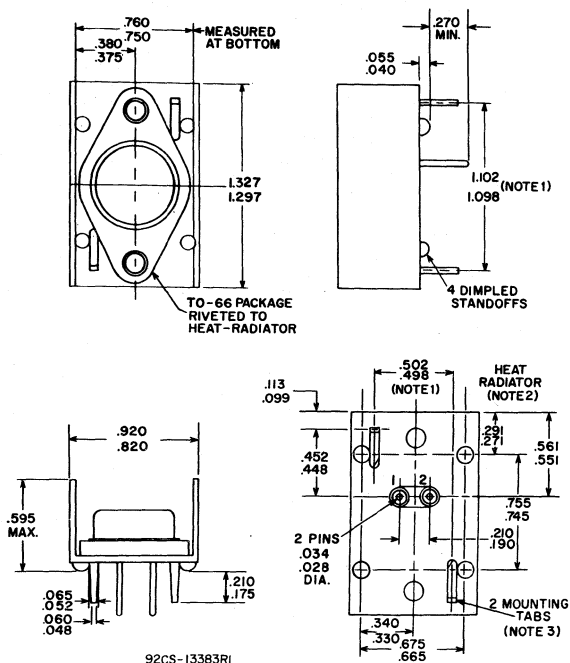
From -65 to 25 °C. P_T 5.8 W
Above 25 °C See Maximum Operating Areas

ELECTRICAL CHARACTERISTICS

Thermal Resistance θ_{JFA} 30 max °C/W
Junction-to-case



DIMENSIONAL OUTLINE
(JEDEC TO-66 WITH HEAT-RADIATOR)



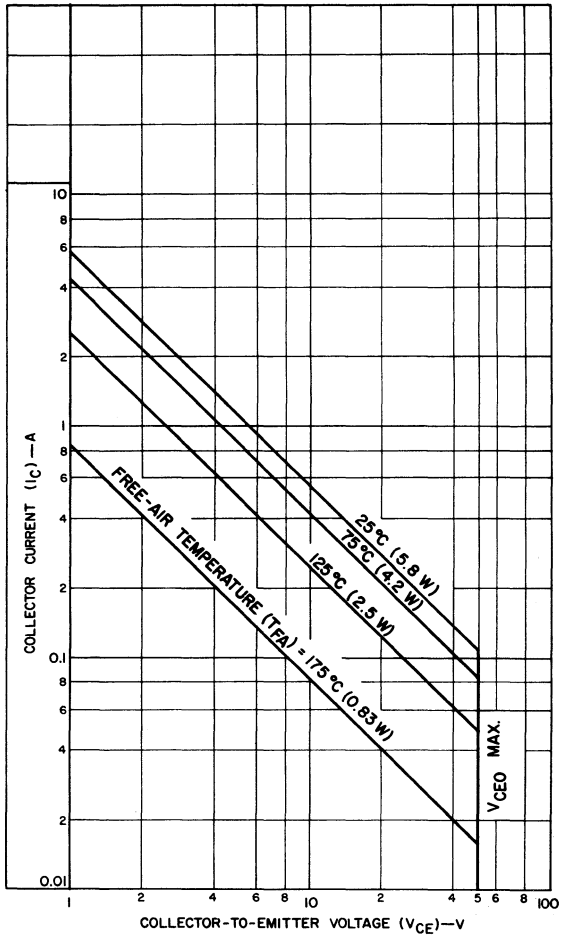
Note 1: Measured at bottom of heat-radiator.

Note 2: 0.035 inch C.R.S., tin plated.

Note 3: Recommended hole size for printed-circuit board is 0.070 inch dia.



Maximum Operating Areas



92SS-2777C



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DATA 2
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40397 to 40400

Transistors

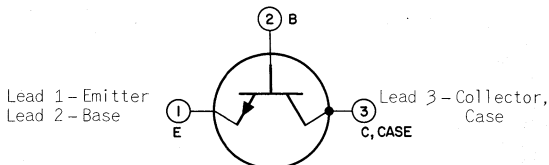
SILICON N-P-N EPITAXIAL PLANAR TYPES

For AF-Amplifier Applications in Commercial and Industrial Equipment such as Preamplifier, Voltage-Amplifier, and Driver-Amplifier Stages of Radio, TV, Phonograph, and Tape-Recorder Equipment

MECHANICAL

Dimensions See accompanying Dimensional Outline

TERMINAL DIAGRAM (Bottom View)



ABSOLUTE-MAXIMUM RATINGS

		40397 40398	40399 40400	
Collector-to-Emitter Voltage . . .	V_{CEV}	25	18	V
$V_{BE} = -1V$				
Collector-to-Emitter Voltage . . .	V_{CE0}	25	18	V
Emitter-to-Base Voltage.	V_{EB0}	7.5	7	V
Collector Current.	I_C	200	200	mA
Emitter Current.	I_E	-200	-200	mA
Base Current	I_B	25	25	mA
Transistor Dissipation				
At case temperatures:				
From -65 to 75 °C	P_T	2	2	W
Above 75 °C	Derate to 0 W at 175 °C			
At ambient temperatures:				
From -65 to 55 °C	P_T	0.4	0.4	W
Above 55 °C	Derate to 0 W at 175 °C			
Temperature Range				
Operating (Junction)	$T(opr)$	-65 to 175		°C
Storage.	$T(stg)$	-65 to 175		°C
Lead-Soldering Temperature ^a		255	255	°C
For 10 s max				

ELECTRICAL CHARACTERISTICS

Unless otherwise specified, electrode-voltage and electrode-current values for given test conditions are dc at case temperature = 25 °C

		40397	40398	40399	40400	
Collector-to-Emitter Breakdown						
Voltage	BV_{CE0}	25	25	18	18 min	V
$I_C = 10\text{ mA}, I_B = 0$						
Emitter-to-Base Breakdown						
Voltage	BV_{EB0}	7.5	7.5	7	7 min	V
$I_E = 0.05\text{ mA}, I_C = 0$						



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40397 to 40400

40397 40398 40399 40400

Collector-to-Emitter Saturation Voltage

$I_B = 10 \text{ mA}, I_C = 200 \text{ mA}$	$V_{CE(sat)}$	0.15	0.15	-	-	typ	V
		0.25	0.25	-	-	max	V
$I_B = 5 \text{ mA}, I_C = 100 \text{ mA}$	$V_{CE(sat)}$	-	-	0.1	0.1	typ	V
		-	-	0.2	0.2	max	V

Base-to-Emitter Saturation Voltage

$I_B = 10 \text{ mA}, I_C = 200 \text{ mA}$	$V_{BE(sat)}$	0.8	0.8	-	-	typ	V
		1.3	1.3	-	-	max	V
$I_B = 5 \text{ mA}, I_C = 100 \text{ mA}$	$V_{BE(sat)}$	-	-	0.75	0.75	typ	V
		-	-	1.3	1.3	max	V

Collector-Cutoff Current

$V_{CB} = 25 \text{ V}, I_E = 0$	I_{CBO}	100	100	-	-	max	nA
$V_{CB} = 25 \text{ V}, I_E = 0, T_C = 85^\circ \text{C}$	I_{CBO}	5	5	-	-	max	μA
$V_{CB} = 12 \text{ V}, I_E = 0$	I_{CBO}	-	-	500	500	max	nA
$V_{CB} = 12 \text{ V}, I_E = 0, T_C = 85^\circ \text{C}$	I_{CBO}	-	-	10	10	max	μA

Collector-Cutoff Current

$V_{BE} = -1 \text{ V}, V_{CE} = 25 \text{ V}$	I_{CEV}	10	10	-	-	max	μA
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Emitter-Cutoff Current

$V_{BE} = -2.5 \text{ V}, I_C = 0$	I_{EBO}	100	100	500	500	max	nA
------------------------------------	-----------	-----	-----	-----	-----	-----	----

DC Forward Current Transfer Ratio

$V_{CE} = 1 \text{ V}, I_C = 100 \text{ mA}$	h_{FE}	100	50	100	50	min	
		245	140	245	140	typ	
		165	75	165	75	min	
$V_{CE} = 10 \text{ V}, I_C = 10 \text{ mA}$	h_{FE}	300	150	300	150	typ	
		600	300	600	300	max	
		-	-	20	20	min	
$V_{CE} = 6 \text{ V}, I_C = 0.5 \text{ mA}$	h_{FE}	175	75	175	75	typ	

Small-Signal Forward Current-

Transfer Ratio	h_{fe}	165	75	165	75	min	
$f = 1 \text{ kHz}, V_{CE} = 12 \text{ V}, I_C = 10 \text{ mA}$		375	200	375	200	typ	

Small-Signal Short Circuit Input

Impedance	h_{ie}	1200	600	1200	600	typ	Ω
$f = 1 \text{ kHz}, V_{CE} = 12 \text{ V}, I_C = 10 \text{ mA}$							

Small-Signal Open Circuit

Output Admittance	h_{oe}	120	75	120	75	typ	μmho
$f = 1 \text{ kHz}, V_{CE} = 12 \text{ V}, I_C = 10 \text{ mA}$							

Small-Signal Open Circuit

Reverse Voltage-Transfer Ratio	h_{re}	250	125	250	125	typ	
$f = 1 \text{ kHz}, V_{CE} = 12 \text{ V}, I_C = 10 \text{ mA}$		$\times 10^{-6}$	$\times 10^{-6}$	$\times 10^{-6}$	$\times 10^{-6}$		

Output Capacitance

C_{ob}		12	12	12	12	typ	pF
$f = 1 \text{ MHz}, V_{CB} = 6 \text{ V}, I_C = 0$		20	20	20	20	max	pF

Gain-Bandwidth Product

f_T		50	50	50	50	min	MHz
$V_{CE} = 6 \text{ V}, I_C = 1 \text{ mA}$		80	80	80	80	typ	MHz

Intrinsic Base-Lead Resistance

r_{bb}		20	20	20	20	typ	Ω
$f = 100 \text{ MHz}, V_{CE} = 6 \text{ V}, I_C = 1 \text{ mA}$		40	40	40	40	max	Ω

Thermal Resistance

Junction-to-case	θ_{JC}	50	50	50	50	max	$^\circ\text{C/W}$
Junction-to-air	θ_{JA}	300	300	300	300	max	$^\circ\text{C/W}$

^a Measured along lead at a distance $\geq 1/32$ inch from seating surface.



OPERATING CONSIDERATIONS

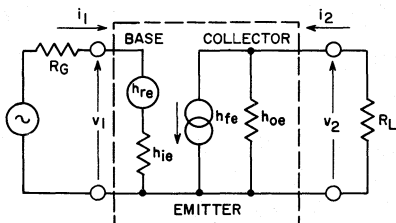
RCA-40397, 40398, 40399, 40400 should not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistors.

The cases of RCA-40397, 40398, 40399, and 40400 are connected internally to the collector electrodes of these transistors. Consequently, in circuits where the collectors of these transistors are operated at voltages above or below chassis or heat-sink potential, suitable precautions should be taken to prevent shock hazards and short circuits between the transistors and chassis, heat sinks, and other components.

Electrical connections to the base, emitter, and collector leads of RCA-40397, 40398, 40399, and 40400 may be soldered directly to the leads, provided such connections are made at least 1/32 inch from the transistor seating surface, and provided care is taken to conduct excessive heat away from the lead seals during soldering. Failure to observe these precautions will result in cracking of the lead seals and permanent damage to the transistors.



LOW-FREQUENCY SMALL-SIGNAL EQUIVALENT CIRCUIT CHARACTERISTICS 40397, 40398, 40399, 40400



92CS-12535

$$\text{Input Resistance} = \frac{V_1}{i_1} = \frac{h_{ie} + (\Delta h R_L)}{1 + (h_{oe} R_L)}$$

$$\text{Output Resistance} = \frac{V_2}{i_2} = \frac{h_{ie} + R_G}{\Delta h + (h_{oe} R_G)}$$

$$\text{Forward Current-Transfer Ratio} = \frac{i_2}{i_1} = \frac{h_{fe}}{1 + (h_{oe} R_L)}$$

$$\text{Forward Voltage-Transfer Ratio} = \frac{V_2}{V_1} = \frac{-h_{fe} R_L}{h_{ie} + (\Delta h R_L)}$$

V_1 = ac input signal voltage

i_1 = ac base current

V_2 = ac output signal voltage

i_2 = ac collector current

h_{ie} = small-signal short-circuit input impedance

h_{oe} = small-signal open-circuit output admittance

h_{re} = small-signal open-circuit reverse voltage-transfer ratio

h_{fe} = small-signal short-circuit forward current-transfer ratio

$$\Delta h = (h_{ie} h_{oe}) - (h_{re} h_{fe})$$

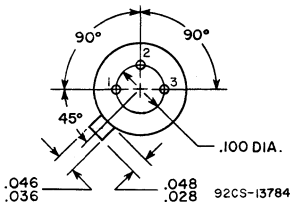
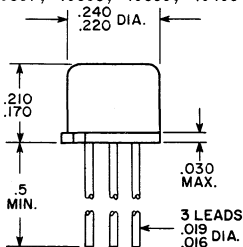
R_G = generator resistance

R_L = load resistance



DIMENSIONAL OUTLINE

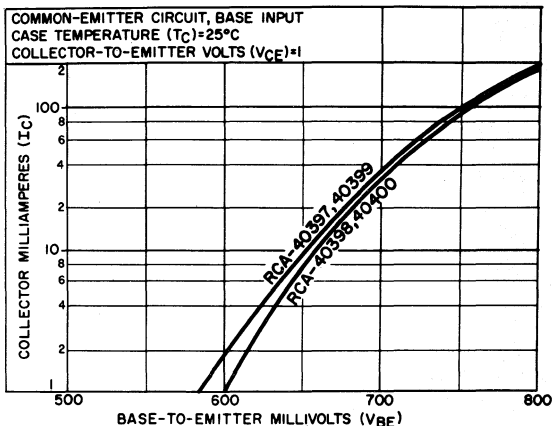
40397, 40398, 40399, 40400



DIMENSIONS IN INCHES

Typical Transfer Characteristics

40397, 40398, 40399, 40400



92CS-13917

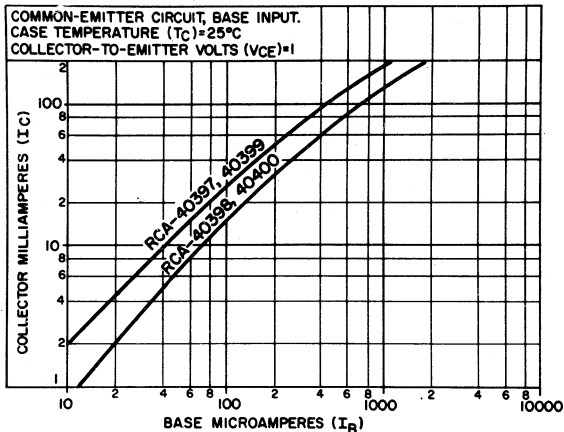


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DATA 3
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Typical Current-Transfer Characteristics

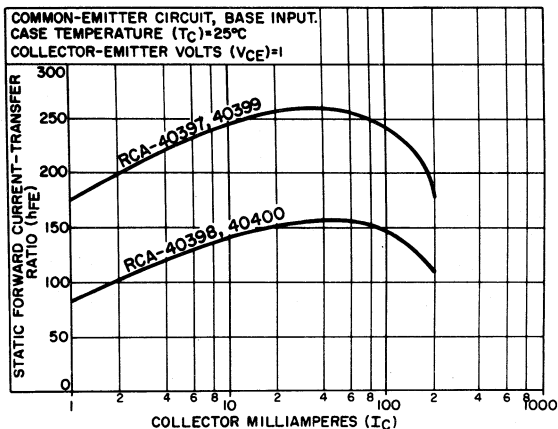
40397, 40398, 40399, 40400



92CS-13913

Typical DC Beta (h_{FE}) Characteristics

40397, 40398, 40399, 40400

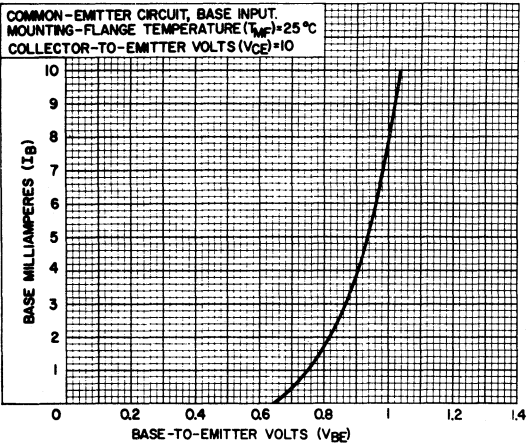


92CS-13914



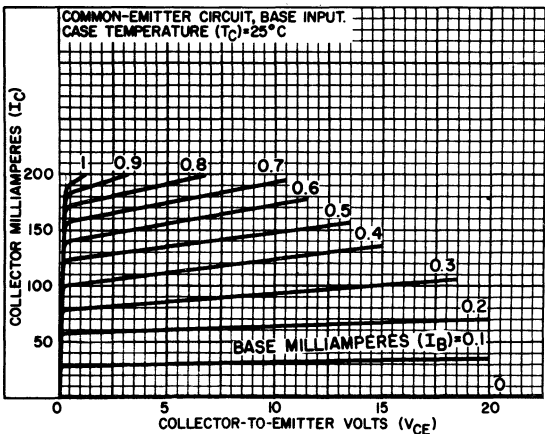
Typical Collector Characteristics

40397



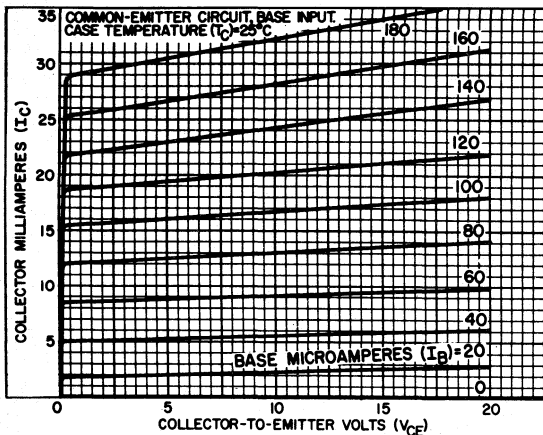
Typical Collector Characteristics

40397



Typical Collector Characteristics

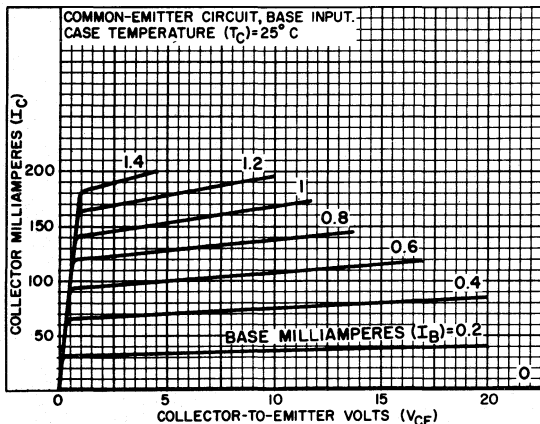
40398



92CS-13918

Typical Collector Characteristics

40398

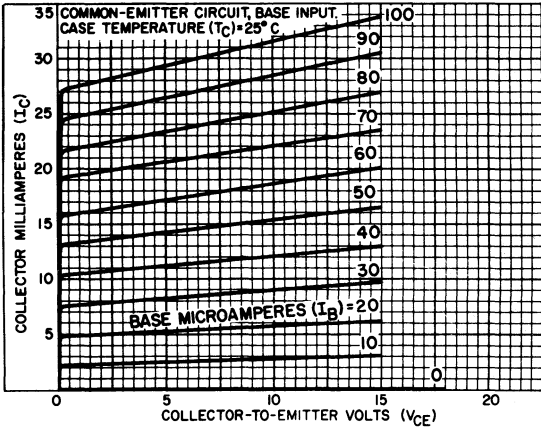


92CS-13916



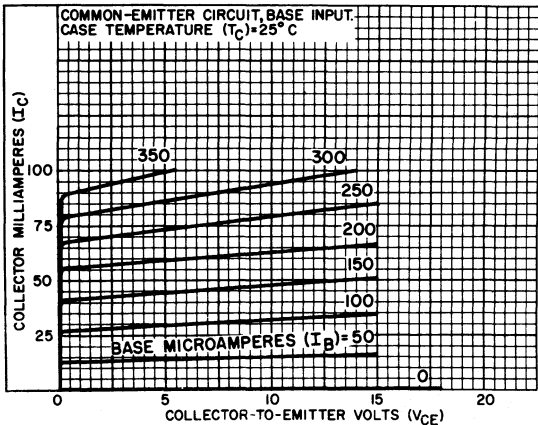
Typical Collector Characteristics

40399



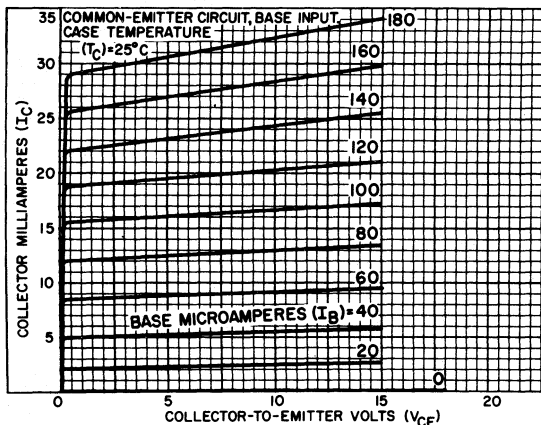
Typical Collector Characteristics

40399



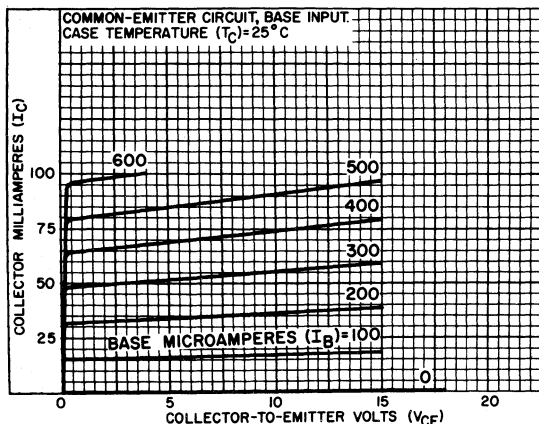
Typical Collector Characteristics

40400



Typical Collector Characteristics

40400



Power Transistors

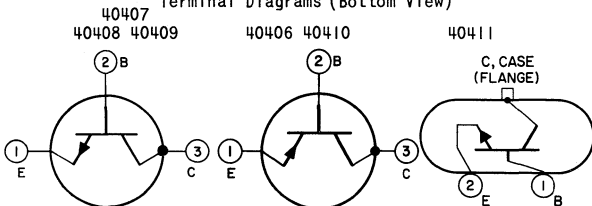
40406 40410—P-N-P SILICON TYPES
40407 40408 40409 40411—N-P-N SILICON TYPES

For Audio Amplifier Applications Requiring High Quality Performance. In a Typical Circuit a 40409 Together with a 40410 Make up a N-P-N—P-N-P Complement to Drive a Pair of Series Connected 40411 Output Transistors, which can Deliver up to 70-Watts of Output Power.

Dimensions

40411. See Outline TO-3 in General Section
40406, 40407, 40408. . . See Outline TO-5 in General Section
40409, 40410. See accompanying Dimensional Outline
(Types with Heat Radiators)

Terminal Diagrams (Bottom View)



Lead 1—Emitter
Lead 2—Base
Lead 3—(40407,
40408) Collector,
Case; (40409)
Collector,
Heat Radiator

Lead 1—Emitter
Lead 2—Base
Lead 3—(40406)
Collector, Case;
(40410) Collector
Heat Radiator

Pin 1—Base
Pin 2—Emitter
Mounting Flange—
Collector,
Case

ABSOLUTE MAXIMUM RATINGS

	40406	40407	40408	40409	40410	40411	
$V_{CE}(sus)$ $R_{BE} = 100 \Omega$	-	-	-	90	-90	90	V
$V_{CE0}(sus)$	-50	50	90	-	-	-	V
V_{EB0}	-4	4	4	4	-4	4	V
I_C	-0.7	0.7	0.7	0.7	-0.7	30	A
I_B	-0.2	0.2	0.2	0.2	-0.2	15	A
PT							
$T_A = -65^\circ$ to $25^\circ C$. .	1	1	1	-	-	-	W
$T_A = -65^\circ$ to $50^\circ C$. .	-	-	-	3	3	-	W
$T_A = -65^\circ$ to $25^\circ C$. .	-	-	-	-	-	150	W
Above $25^\circ C$ (or $50^\circ C$). .	←Derate linearly to 0W at $200^\circ C$ →					(a)	
Temperature Range $T_{J(opr)}$	← -65 to 200 →						$^\circ C$

Definitions of symbols are given at end of data.



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DATA 1
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40406 to 40411

ELECTRICAL CHARACTERISTICS

Unless otherwise specified, electrode-voltage and electrode-current values for given test conditions are dc at case temperature = 25 °C

	40406	40407	40408	40409	40410	40411		
V_{CE}(sus)								
R _{BE} = 100 Ω,								
I _C = 100 mA	-	-	-	90	-	-	min	V
I _C = -100 mA	-	-	-	-	-90	-	min	V
I _C = 200 mA	-	-	-	-	-	90	min	V
V_{CE0}(sus)								
I _C = -100 mA, I _E = 0	-50	-	-	-	-	-	min	V
I _C = 100 mA, I _E = 0	-	50	90	-	-	-	min	V
V_{BE}								
V _{CE} = -10 V,								
I _C = -0.1 mA	-0.8	-	-	-	-	-	max	V
V _{CE} = 10 V,								
I _C = 1 mA	-	0.8	-	-	-	-	max	V
V _{CE} = 4 V,								
I _C = 10 mA	-	-	1	-	-	-	max	V
I _C = 150 mA	-	-	-	1	-	-	max	V
I _C = 4 A	-	-	-	-	-	1.2	max	V
V _{CE} = -4 V,								
I _C = -150 mA	-	-	-	-	-1	-	max	V
V_{CE}(sat)								
I _B = 15 mA,								
I _C = 150 mA	-	-	1.4	1.4	-	-	max	V
I _C = -150 mA	-	-	-	-	-1.4	-	max	V
I _B = 400 mA,								
I _C = 4 A	-	-	-	-	-	0.8	max	V
I_{CEO}								
V _{CE} = -40 V, I _B = 0								
T _C = 25 °C	-1	-	-	-	-	-	max	μA
T _C = 150 °C	-10	-	-	-	-	-	max	μA
V _{CE} = 40 V, I _B = 0								
T _C = 25 °C	-	1	-	-	-	-	max	μA
T _C = 150 °C	-	100	-	-	-	-	max	μA
V _{CE} = 80 V, I _B = 0								
T _C = 25 °C	-	-	1	-	-	-	max	μA
T _C = 150 °C	-	-	250	-	-	-	max	μA
I_{CER}								
V _{CE} = 80 V, R _{BE} = 100 Ω								
T _C = 25 °C	-	-	-	1	-	500	max	μA
T _C = 150 °C	-	-	-	100	-	2	max	mA
V _{CE} = -80 V, R _{BE} = 100 Ω								
T _C = 25 °C	-	-	-	-	-1	-	max	μA
T _C = 150 °C	-	-	-	-	-100	-	max	μA
I_{EB0}								
V _{EB} = -4 V, I _C = 0	-1	-	-	-	-1	-	max	mA
V _{EB} = 4 V, I _C = 0	-	1	1	1	-	5	max	mA
h_{FE}								
V _{CE} = -10 V,								
I _C = -0.1 mA	{ 30	-	-	-	-	-		
V _{CE} = 10 V,	{ 200	-	-	-	-	-		
I _C = 1 mA	-	{ 40	-	-	-	-		
		{ 200	-	-	-	-		



	40406	40407	40408	40409	40410	40411	
h_{FE} (cont'd)							
$V_{CE} = 4 \text{ V}, I_C = 10 \text{ mA}$. . .	-	-	{ 40 200	-	-	-	
$V_{CE} = 4 \text{ V}, I_C = 4 \text{ A}$	-	-	-	-	-	{ 35 100	
$V_{CE} = 4 \text{ V}, I_C = 150 \text{ mA}$. .	-	-	-	{ 50 250	-	-	
$V_{CE} = -4, I_C = -150 \text{ mA}$. .	-	-	-	-	{ 50 250	-	
f_T							
$V_{CE} = -4 \text{ V}, I_C = -50 \text{ mA}$. . .	100	-	-	-	100	-	typ Mc/s
$V_{CE} = 4 \text{ V}, I_C = 50 \text{ mA}$. . .	-	100	100	100	-	-	typ Mc/s
$V_{CE} = 4 \text{ V}, I_C = 4 \text{ A}$	-	-	-	-	-	800	typ kc/s
PRT	-	-	-	-	-	1	min s
For 200 W, $V_{CE} = 40 \text{ V}$, $I_C = 5 \text{ A}$							
θ_{JA}	175	175	175	50	50	-	max $^{\circ}\text{C/W}$
θ_{JC}	35	35	35	-	-	1.17	max $^{\circ}\text{C/W}$

^a See accompanying Dissipation Derating Curve.

SYMBOLS AND TERMS

The transistor symbols are listed alphabetically with their associated terms.

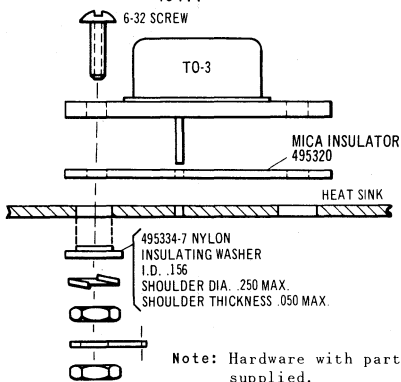
f_T	Gain-bandwidth product
h_{FE}	DC forward-current transfer ratio (common-emitter circuit)
I_B	DC base current
I_C	DC collector current
I_{CE0}	DC collector-cutoff current, base open
I_{CER}	DC collector-cutoff current with specified external base-to-emitter resistance
I_{EBO}	DC emitter-cutoff current, collector open
PRT	Power rating test
PT	Transistor dissipation
R_{BE}	External base-to-emitter resistance
T_A	Ambient Temperature
T_C	Case Temperature
V_{BE}	DC base-to-emitter voltage
$V_{CE0}(\text{sus})$	DC collector-to-emitter sustaining voltage, base open
$V_{CER}(\text{sus})$	DC collector-to-emitter sustaining voltage with specified external base-to-emitter resistance
$V_{CE}(\text{sat})$	DC collector-to-emitter saturation voltage
V_{EBO}	DC emitter-to-base voltage, collector open
θ_{JA}	Thermal resistance, junction-to-air
θ_{JC}	Thermal resistance, junction-to-case



40406 to 40411

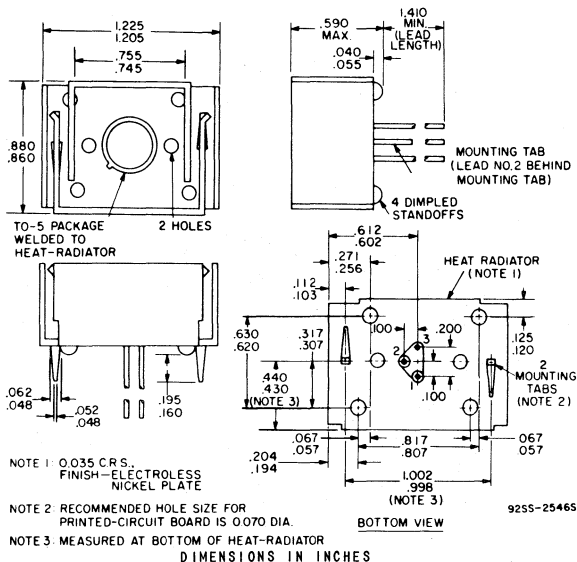
SUGGESTED HARDWARE

40411



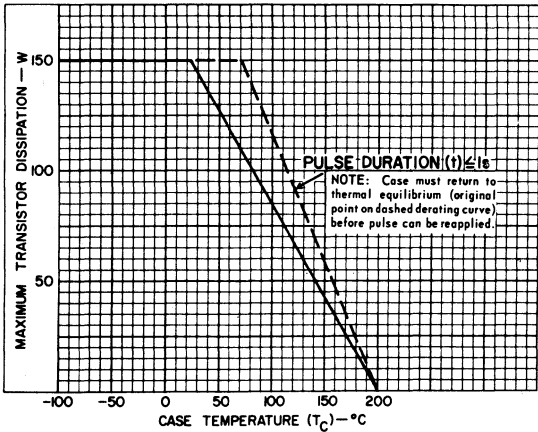
9255-27025

DIMENSIONAL OUTLINE (JEDEC TO-5 WITH HEAT-RADIATOR) 40409 40410



Dissipation Derating Curve

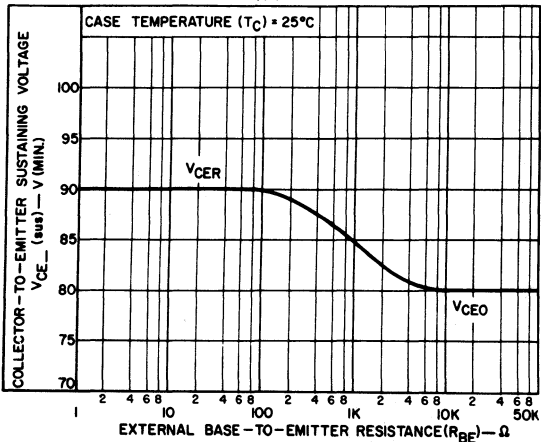
40411



92CS-13181

Typical Collector-to-Emitter Voltage Characteristics

40411



92SS-3080C

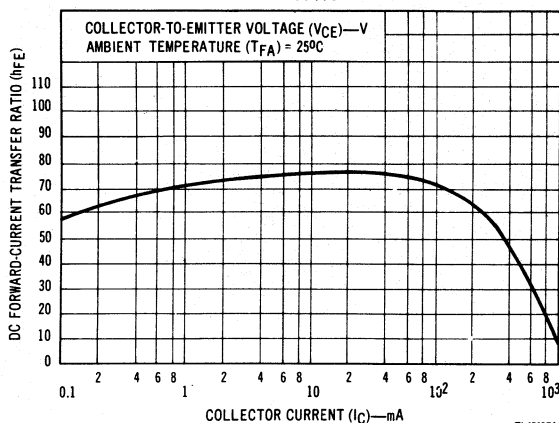


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DATA 3
6-66

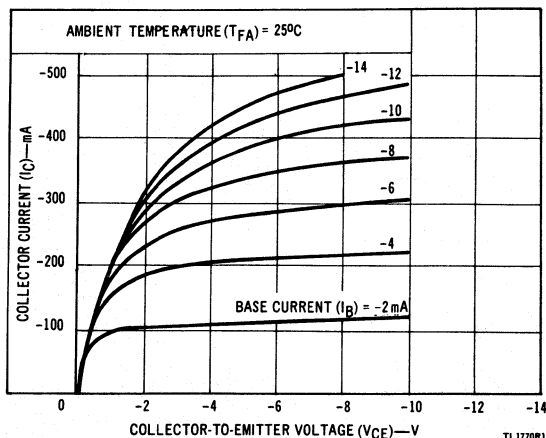
Typical h_{FE} (DC Beta) Characteristics

40406 40410



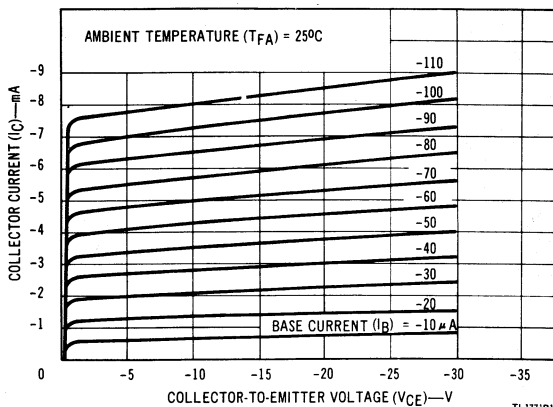
Typical Collector Characteristics

40406 40410



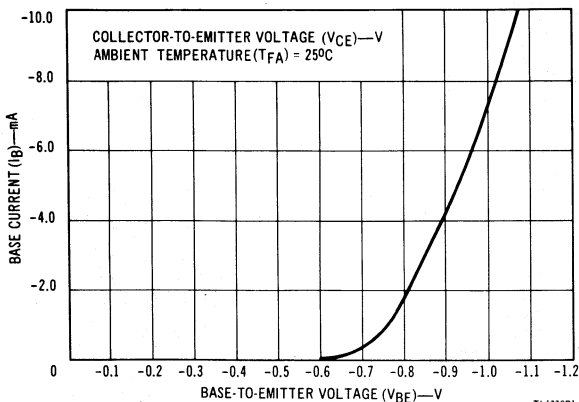
Typical Collector Characteristics

40406 40410



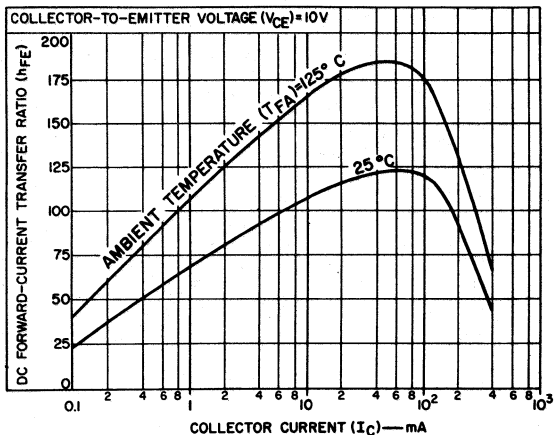
Typical Base (Input) Characteristics

40406 40410



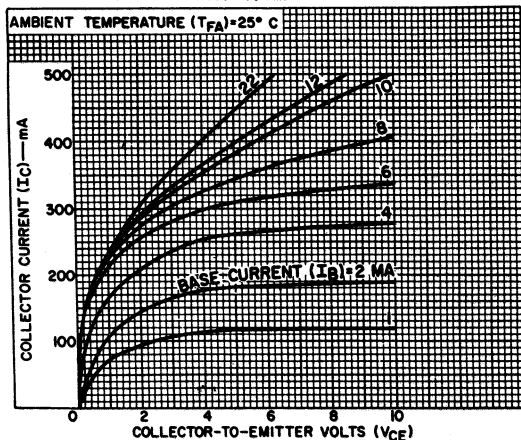
Typical h_{FE} (DC Beta) Characteristics

40407 40408 40409



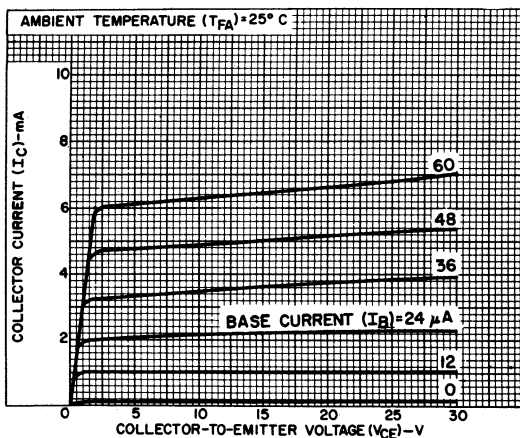
Typical Collector Characteristics

40407 40408 40409



Typical Collector Characteristics

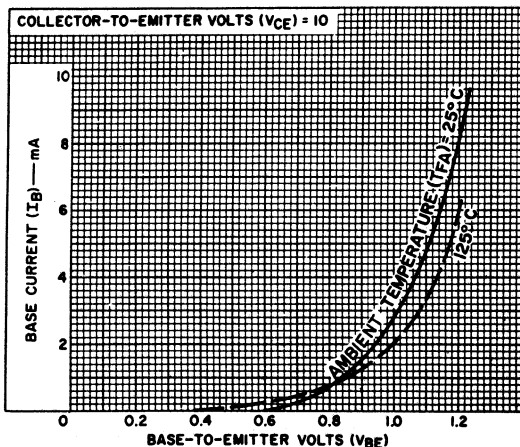
40407 40408 40409



92CS-13003R2

Typical Base (Input) Characteristics

40407 40408 40409



92CS-12329R2



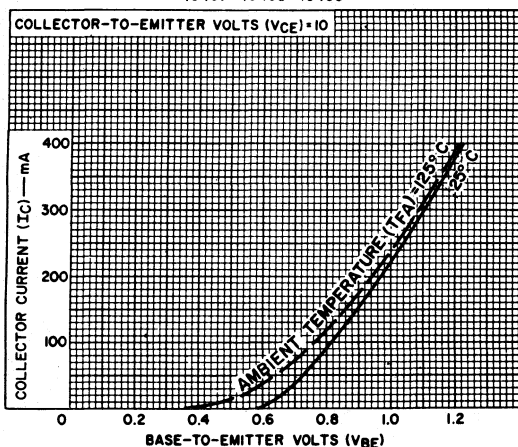
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DATA 5
6-66

Typical Transfer Characteristics

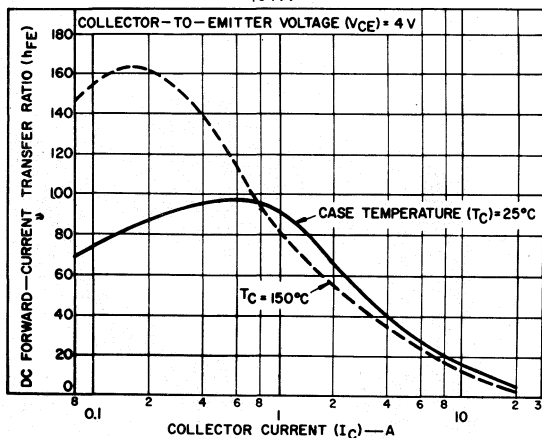
40407 40408 40409



92CS-12328R2

Typical h_{FE} (DC Beta) Characteristics

40411

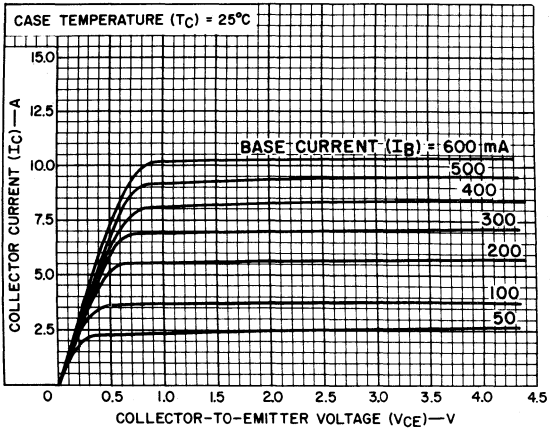


92SS-3079C

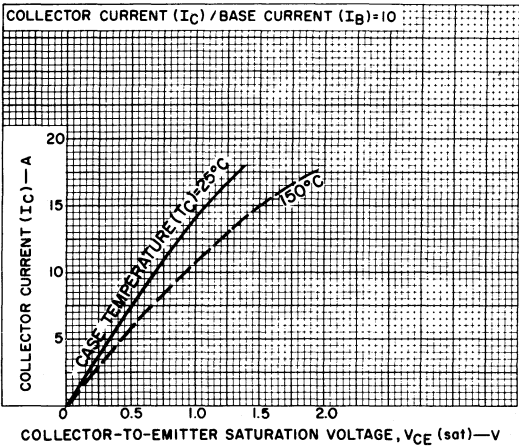


Typical Collector Characteristics

40411

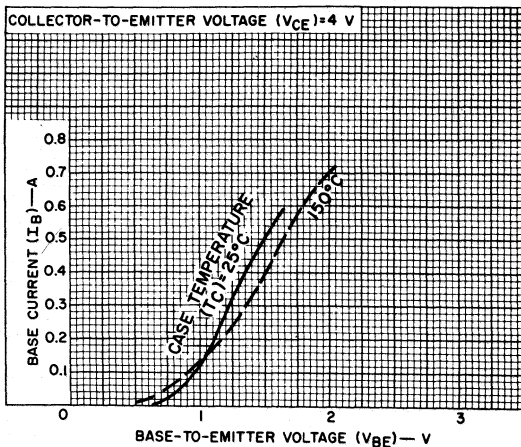


40411



Typical Base (Input) Characteristics

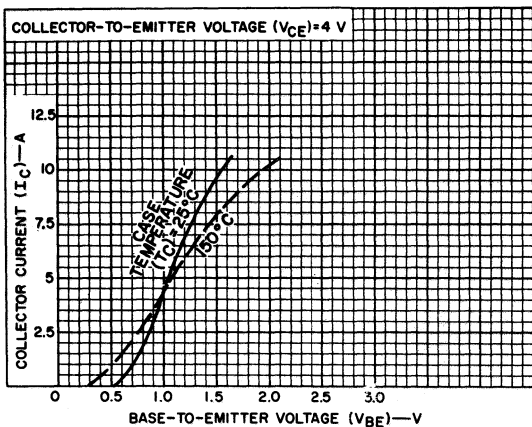
40411



92CS-13187

Typical Transfer Characteristics

40411



92CS-13188



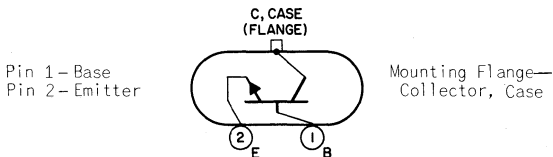
Power Transistor

DRIFT FIELD GERMANIUM P-N-P DIFFUSED-COLLECTOR, GRADED-BASE TYPE

For Use in Class B High-Fidelity Amplifiers and Other AF Amplifiers Which are Required to Provide Relatively Large Power Outputs Over a Wide Frequency Range With Low Distortion

MECHANICAL

Dimensions. See Outline TO-3 in General Section
 TERMINAL DIAGRAM (Bottom View)



ABSOLUTE-MAXIMUM RATINGS

Collector-to-Base Voltage	V_{CB0}	-75	V
Collector-to-Emitter Voltage.	V_{CE0}	-50	V
Emitter-to-Base Voltage	V_{EB0}	-1.5 ^a	V
Collector Current	I_C	-5	A
Base Current.	I_B	-1	A
Emitter Current	I_E	5	A

Transistor Dissipation

Average mounting-flange temperatures:^b

Up to 81°C. P_T 12.5 W

Above 81°C. Derate linearly 0.66 W/°C

Peak mounting-flange temperatures:

Determined by operating conditions. See *Typical Collector Characteristics*

Temperature Range

Operating (Junction).	T_{opr}	-65 to 100	°C
Storage	T_{stg}	-65 to 100	°C
Pin-Soldering Temperature ^c		255	°C
For 10 s max			

ELECTRICAL CHARACTERISTICS

Electrode voltage and electrode current values for given test conditions are dc at mounting-flange temperature = 25°C^b

		Min	Typ	Max	
Collector-to-Base Breakdown					
Voltage.	BV_{CB0}	-75	-	-	V
I_C (Pulsed) = -10 mA, ^d $I_E = 0$					
Collector-to-Emitter					
Sustaining Voltage	$V_{CE0(sus)}$	-50	-	-	V
$I_C = -100$ mA, $I_B = 0$					



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 6-66

Base-to-Emitter Voltage

$V_{CE} = -10 \text{ V}, I_C = -50 \text{ mA} \dots$	V_{BE}	0.21	0.24	0.28	V
--	----------	------	------	------	---

$V_{CE} = -2 \text{ V}, I_C = -1 \text{ mA} \dots$	V_{BE}	-	-	0.5	V
--	----------	---	---	-----	---

Collector-Cutoff Current. $\dots$	I_{CBO}	-	-	-1	mA
--	-----------	---	---	----	----

 $V_{CB} = -40 \text{ V}, I_E = 0$ **Collector-Cutoff Saturation**

Current. $\dots \dots \dots$	$I_{CBO}(\text{sat})$	-	-	-70	μA
-------------------------------------	-----------------------	---	---	-----	---------------

 $V_{CB} = -0.5 \text{ V}, I_E = 0$

Emitter-Cutoff Current. $\dots$	I_{EBO}	-	-	-2.5	mA
--	-----------	---	---	------	----

 $V_{BE} = 1.5 \text{ V}, I_C = 0$ **DC Forward Current-Transfer Ratio**

$V_{CE} = -2 \text{ V}, I_C = -1 \text{ A} \dots$	h_{FE}	62	100	175	
---	----------	----	-----	-----	--

$V_{CE} = -2 \text{ V}, I_C = -4 \text{ A} \dots$	h_{FE}	40	-	-	
---	----------	----	---	---	--

Gain-Bandwidth Product. $\dots$	f_T	2	4	-	MHz
--	-------	---	---	---	-----

 $V_{CE} = -5 \text{ V}, I_C = -500 \text{ mA}$

Thermal Resistance. $\dots \dots$	θ_{JMF}	-	-	1.5	$^{\circ}\text{C/W}$
--	----------------	---	---	-----	----------------------

Junction-to-mounting flange

^a This rating may be exceeded provided the combined dissipation in the emitter and the collector does not exceed the maximum dissipation rating for the device, and provided the driver stage (transformer coupled) is capable of providing the emitter-to-base current drawn by the transistors under the emitter-to-base voltage conditions (reverse-bias) shown.

^b Measured at center of seating surface.

^c Measured along pin at a distance $\geq 1/16$ inch from seating surface.

^d Pulse duration $\geq 300 \mu\text{s}$; duty factor = 0.01.

OPERATING CONSIDERATIONS

In the design of amplifier circuits using RCA-40421 it is extremely important to assure that the operating characteristic does not, under any foreseeable combination of operating conditions, extend outside the safe operating region shown in *Typical Collector Characteristics*. Even momentary excursion of the transistor operating characteristic outside this region, or momentary operation of the transistor above any of its maximum ratings can result in permanent damage to the transistor.

To assure that the 40421 is operated at all times within the safe region shown in *Typical Collector Characteristics* the circuit designer should take into account the possible effects of the following factors:

- (1) phase shift due to circuit capacitances and/or speaker resonance
- (2) parasitic oscillations, such as "ringing" caused by excessive or improperly neutralized feedback
- (3) high line voltage
- (4) variations in speaker impedance
- (5) overdriving of transistors
- (6) non-sinusoidal signal waveforms

Any of these factors, or combination, can change the character and value of the transistor load sufficiently to cause operation outside the safe operating region shown in *Typical*



Collector Characteristics.

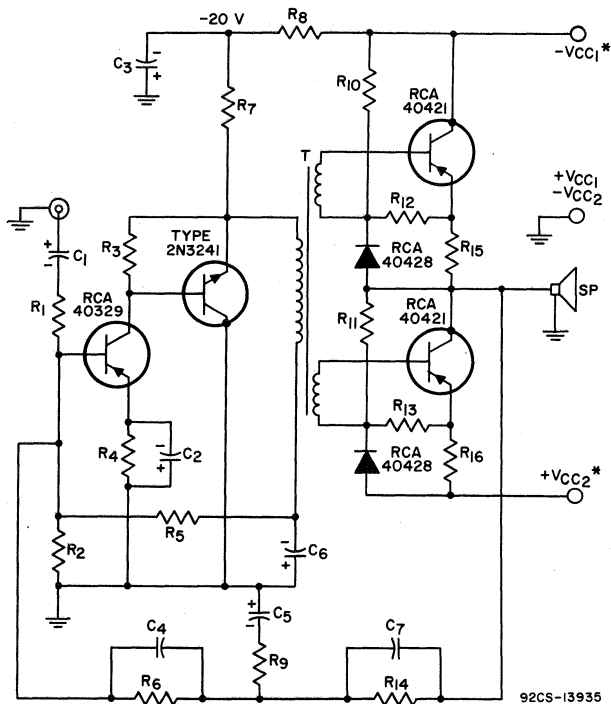
Because the metal shell of 40421 operates at the collector voltage, consideration should be given to the possibility of shock hazard if the shell is to operate at a voltage appreciably above or below ground potential. In such cases, suitable precautionary measures should be taken.

The 40421 should not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

It is essential that the mounting flange which serves as the collector terminal be securely fastened to a heat sink, which may be the equipment chassis. Under no circumstances, however, should the mounting flange be soldered to the heat sink or chassis because the heat of the soldering operation will permanently damage the transistor.



SCHEMATIC DIAGRAM OF 25-WATT HIGH-QUALITY POWER AMPLIFIER USING 40421, 40329, AND 2N3241 TRANSISTORS, AND 40428 COMPENSATING DIODE



92CS-13935

$C_1 = 5 \mu\text{F}$, 3 V, electrolytic
 $C_2 = 200 \mu\text{F}$, 3 V, electrolytic
 $C_3 = 2500 \mu\text{F}$, 35 V, electrolytic
 $C_4, C_7 = 39 \text{ pF}$, mica
 $C_5 = 10 \mu\text{F}$, 3 V, electrolytic
 $C_6 = 250 \mu\text{F}$, 15 V, electrolytic
 $R_1 = 1500 \Omega$, 0.5 W
 $R_2 = 22 \text{ K}\Omega$, 0.5 W
 $R_3 = 270 \Omega$, 0.5 W
 $R_4, R_9 = 1 \text{ K}\Omega$, 0.5 W
 $R_5 = 56 \text{ K}\Omega$, 0.5 W
 $R_6 = 22 \text{ K}\Omega$, 0.5 W
 $R_7 = 330 \Omega$, 1 W
 $R_8 =$ Selected to provide 20 V across C_3 under zero-signal conditions

$R_{10}, R_{11} = 270 \Omega$, 2 W
 $R_{12}, R_{13} = 22 \Omega$, 5 W
 $R_{14} = 33 \text{ K}\Omega$, 0.5 W
 $R_{15}, R_{16} = 0.47 \Omega$, 0.5 W

T = Driver Transformer:
 Turns ratio, primary to each
 secondary: 3:1
 Primary impedance: 400 Ω
 Primary dc: 0 mA

* V_{CC1}, V_{CC2} : Zero-signal value =
 22 V ($I = 150 \text{ mA}$)
 Maximum-signal value =
 20 V ($I = 1 \text{ A}$)



Performance Specifications for 4 Ω Speaker Load:

Continuous (Sine-Wave) Power Output = 25 W

EIA Music Power Output^e = 40 W

Total Harmonic Distortion at 25 W output, F = 1 kHz = 0.5%

Sensitivity = 50 mV rms input for 25 W output at 1 kHz

Frequency Response = 1-1 dB down at 20 Hz and 20 kHz

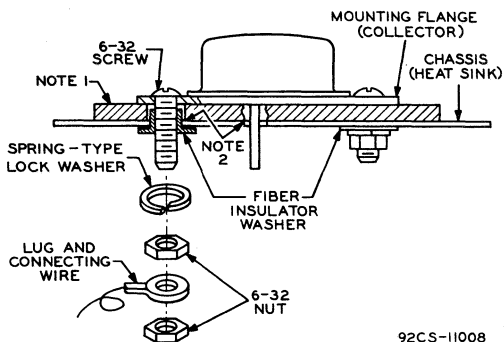
2-3 dB down at 15 Hz and 35 kHz

Input Resistance = 1500 Ω

Hum and Noise - 80 dB below 25 W, input open or shorted

^eEIA Standard No. RS 234, Section 2.1.2.1

SUGGESTED MOUNTING ARRANGEMENT



92CS-11008

Note 1: 0.002" mica insulator or anodized aluminum insulator (Drilled or punched with burrs removed).

Note 2: Remove burrs from chassis holes.

Mounting hardware for RCA-40421 is available from RCA Distributors under the following RCA Part Numbers:

ITEM	RCA PART NO.
Mica Insulator	495320
Nylon Insulating Washer (2)	495334-7

Mica insulators are also available from Reliance Mica Co., 341-351 39th St., Brooklyn, N.Y. 10032, United Mineral & Chemical Corp., 16 Hudson St., N.Y., N.Y. 10014, and other suppliers of similar components.

Insulating shoulder washers are also available from Contour Plastics, Minneapolis, Minn. and other suppliers of similar components.

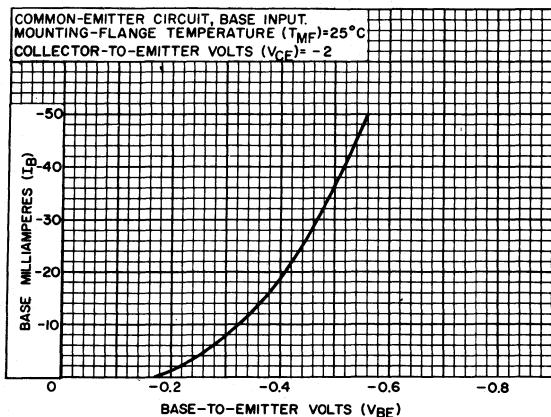
Sockets for RCA-40421 and other semiconductor devices utilizing the JEDEC TO-3 package are made by several manufacturers, and are generally available from electronic parts distributors.



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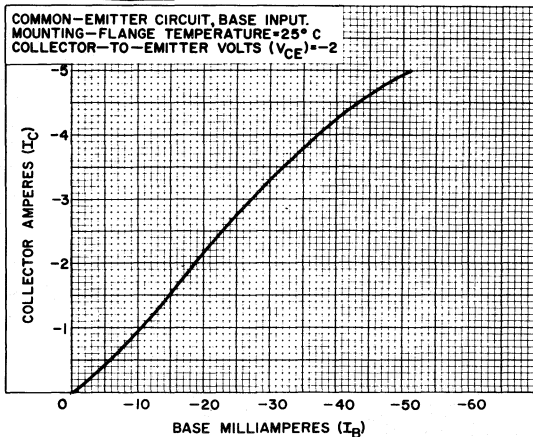
DATA 3
6-66

Typical Input Characteristics



92CS-11329R2

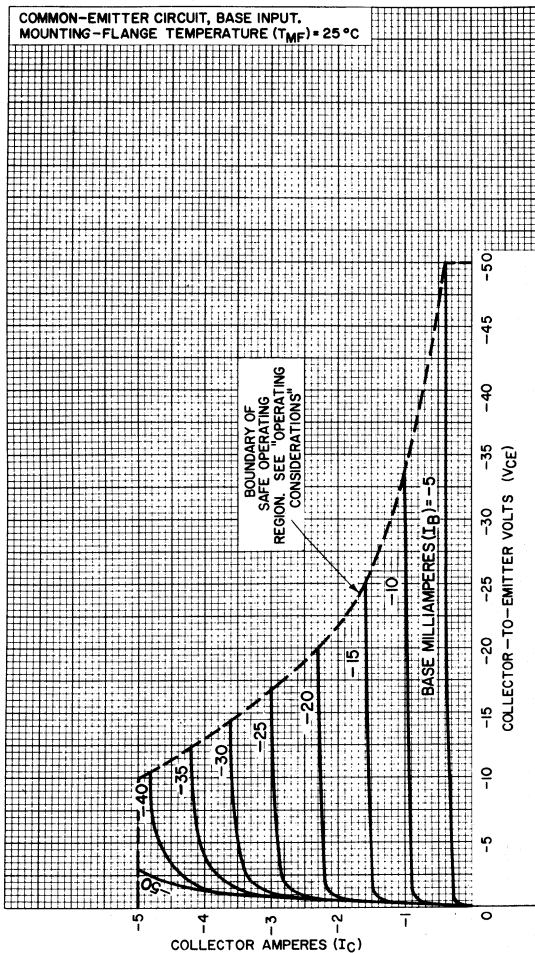
Typical Current-Transfer Characteristic



92CS-10993R1



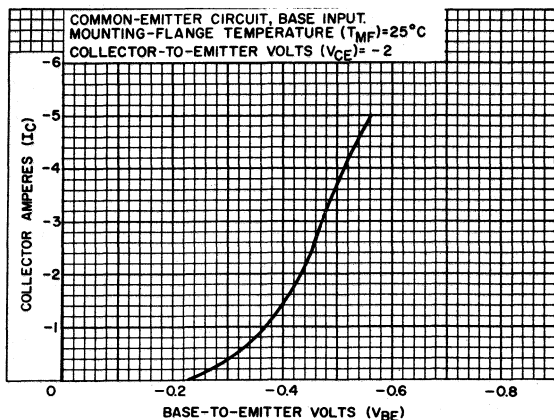
Typical Collector Characteristics



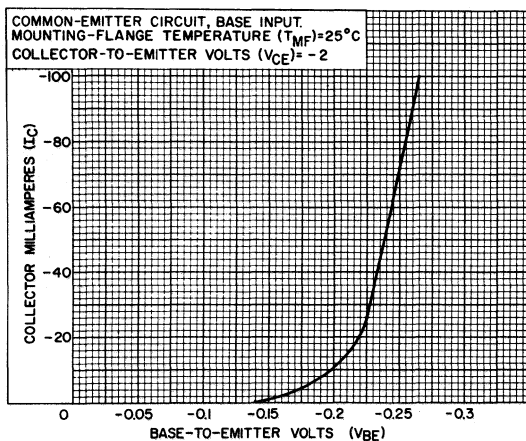
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DATA 4
6-66

Typical Transfer Characteristic



Typical Transfer Characteristic



40422 to 40427

Power Transistors

SILICON N-P-N HIGH-VOLTAGE TYPES

For Use as Class A Amplifiers in AF-Output Stages of AC- and AC/DC-Line-Operated Radio Receivers, Phonographs, Television Receivers, and other Entertainment-Type Electronic Equipment

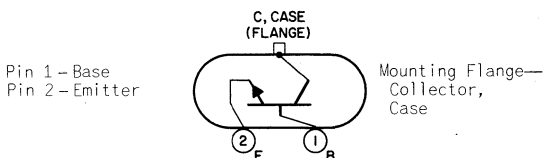
Types 40422, 40424, and 40426 differ from types 40423, 40425, and 40427, respectively, only in mechanical configuration and dissipation capability.

MECHANICAL

Dimensions

40422, 40424, 40426. . . See Outline TO-66 in General Section
40423, 40425, 40427. . . See accompanying Dimensional Outline

TERMINAL DIAGRAM (Bottom View)



ABSOLUTE-MAXIMUM RATINGS

For types 40422 thru 40427

Collector-to-Base Voltage	V_{CBO}	300	V
Collector-to-Emitter Voltage.	V_{CEX}	300	V
Sustaining value at $I_C = 5\text{ mA}$, $I_B = 5\text{ }\mu\text{A}$			
Emitter-to-Base Voltage	V_{EBO}	2	V
Collector Current	I_C	150	mA
Base Current.	I_B	150	mA
Emitter Current	I_E	-150	mA
Temperature Range			
Operating (Junction).	$T(\text{opr})$	-65 to 150	$^{\circ}\text{C}$
Storage	$T(\text{stg})$	-65 to 150	$^{\circ}\text{C}$
Pin-Soldering Temperature ^a		255	$^{\circ}\text{C}$
For 10 s max			

For types 40422, 40424, 40426

Transistor Dissipation

At mounting-flange temperatures:

From -65 to 70 $^{\circ}\text{C}$	P_T	8	W
Above 70 $^{\circ}\text{C}$	Derate linearly to 0 W at 150 $^{\circ}\text{C}$		

For types 40423, 40425, 40427

Transistor Dissipation

At ambient temperatures:

From -65 to 55 $^{\circ}\text{C}$	P_T	3.8	W
Above 55 $^{\circ}\text{C}$	Derate linearly to 0 W at 150 $^{\circ}\text{C}$		



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DATA 1
6-66

40422 to 40427

ELECTRICAL CHARACTERISTICS

Electrode voltage and electrode current values for given test conditions are dc at mounting-flange temperature = 25°C^a

Values apply to all types except where indicated otherwise

	Min	Typ	Max	
Emitter-to-Base Breakdown Voltage .BV _{EB0}	2	-	-	V
I _E = 0.1 mA, I _C = 0				
Collector-Cutoff Current				
V _{CB} = 300 V, I _E = 0 IC _{B0}	-	-	100	μA
V _{CE} = 300 V, I _B = 5 μA IC _{EX}	-	-	5	mA
DC Forward Current-Transfer Ratio				
V _{CE} = 10 V, I _C = 50 mA				
40422, 40423 h _{FE}	50	80	250	
40424, 40425 h _{FE}	30	60	150	
40426, 40427 h _{FE}	20	35	100	
Gain-Bandwidth Product f _T	-	25	-	MHz
V _{CE} = 50 V, I _C = 20 mA				
Output Capacitance (Open Circuit) . C _{ob}	-	5	-	pF
V _{CB} = 50 V, I _E = 0				
Intrinsic Base-Lead Resistance . . . r _{bb'}	-	20	-	Ω
f = 100 MHz, V _{CE} = 50 V, I _C = 20 mA				
Thermal Resistance				
Junction-to-mounting flange ^a				
40422, 40424, 40426 θ _{JMF}	-	8	10	°C/W
Junction-to-air				
40423, 40425, 40427 θ _{JA}	-	-	25	°C/W

^a Measured at center of seating surface.

OPERATING CONSIDERATIONS

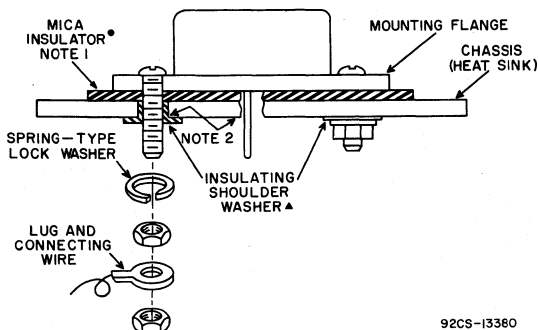
It is essential that the mounting flanges of the 40422, 40424, and 40426, which are internally connected to the collectors, be securely fastened to heat sinks, which may be the equipment chassis. Under no circumstances, however, should the mounting flange be soldered to the heat sink or chassis because the heat of the soldering operation will permanently damage the transistor.

The mounting-flange temperature of the 40422, 40424, or 40426 will be higher than the ambient (free-air) temperature by an amount which depends on the heat sink used. The heat sink must have sufficient thermal capacity to assure that the heat dissipated in the heat sink itself does not raise the transistor-mounting-flange temperature above the design value.

Depending on the application, the heat sink or chassis may be connected to either the positive or negative terminal of the voltage supply.



SUGGESTED MOUNTING ARRANGEMENT
40422 40424 40426



92CS-13380

Note 1: 0.002 inch thick mica or anodized aluminum insulator drilled or punched with burrs removed.

Note 2: Remove burrs from chassis holes.

- Available from RCA Distributors as Part No.DF31A. Also available from Reliance Mica Co., 341-351 39th St., Brooklyn, N.Y. 10032, United Mineral & Chemical Corp., 16 Hudson St., N.Y., N.Y. 10014, and other suppliers of similar components.

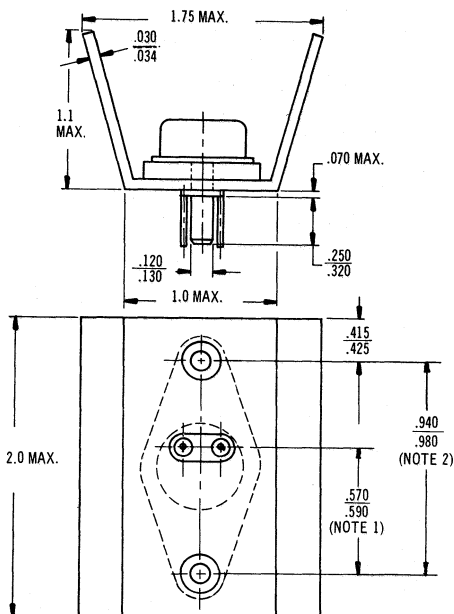
- ▲ Available from RCA Distributors as Part No.495334-7. Also available from Contour Plastics, Minneapolis, Minn. and other suppliers of similar components.

RCA-40422, 40424, and 40426 fit socket PTS-4 (United International Dynamics Corp., 2029 Taft St., Hollywood, Fla.), or equivalent.



40422 to 40427

DIMENSIONAL OUTLINE (JEDEC No.66 With Heat Radiator) 40423 40425 40427



92SS2778R2

DIMENSIONS IN INCHES

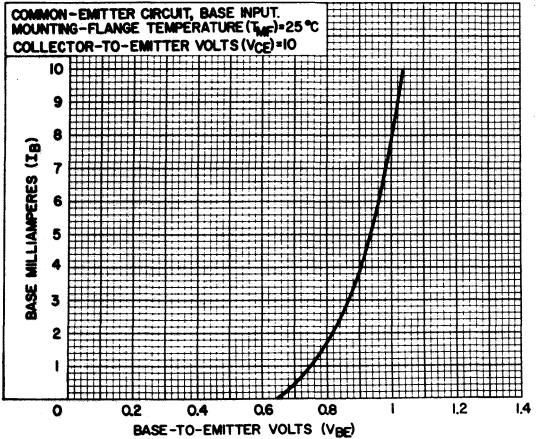
Note 1: Measured at underside of aluminum cooling flange.

Note 2: Measured between center lines of tips of mounting pins.



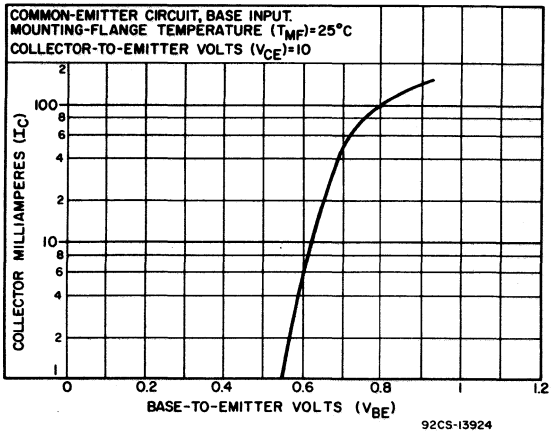
Typical Input Characteristic

40422 40423 40424 40425 40426 40427



Typical Transfer Characteristic

40422 40423 40424 40425 40426 40427

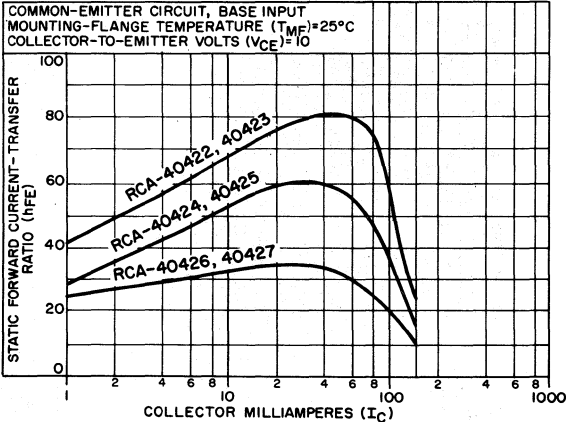


RADIO CORPORATION OF AMERICA
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DATA 3
6-66

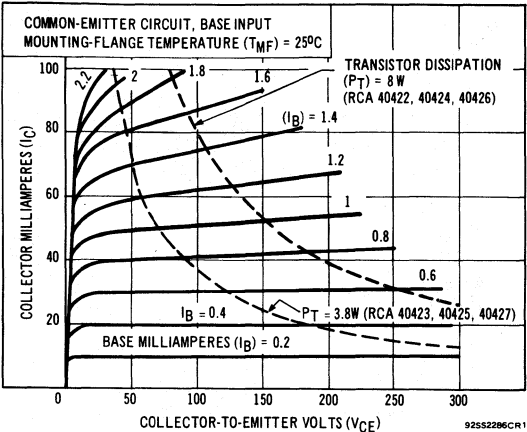
Static Beta (hFE) vs. Collector Current

40422 40423 40424 40425 40426 40427



Typical Collector Characteristics

40422 40423 40424 40425 40426 40427



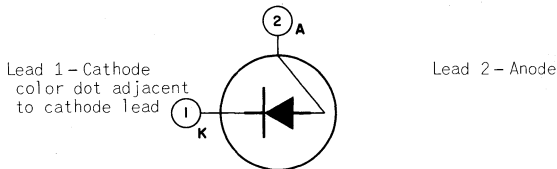
Semiconductor Diode

GERMANIUM ALLOY-JUNCTION TYPE

Designed to Compensate for the Effects of Temperature and Supply Voltage Changes on the Operation of Class B Push-Pull AF Power Amplifier Stages Using Drift-Field Power Transistors Such as Types 40421, 2N2147, 2N2148, and Similar Types

MECHANICAL

Dimensions. See accompanying Dimensional Outline
TERMINAL DIAGRAM (Bottom View)



The arrow indicates direction of forward current

TEMPERATURE- AND VOLTAGE-COMPENSATION SERVICE

Reverse Voltage ^a	V_R	-0.5 max	V
DC Forward Current.	I_F	100 max	mA
Peak Forward Current.	i_{FM}	200 max	mA
Ambient Temperature Range			
Operating (Junction).	$T(opr)$	-65 to 85	°C
Storage	$T(stg)$	-65 to 85	°C
Lead-Soldering Temperature ^b		255	°C
For 10 s max			

ELECTRICAL CHARACTERISTICS

At a DC Forward Current, $I_F = 80$ mA, and Under Conditions of Thermal Equilibrium

Forward Voltage Drop	Min	Typ	Max	
At case temperature, $T_C = 25^\circ\text{C}$. . . VF	235	260	285	mV
At ambient temperature, $T_A = 25^\circ\text{C}$. . . VF	225	250	275	mV

^a The 40428 is not intended for operation with reverse voltages.

^b Measured along lead at a distance $\geq 1/32$ inch from seating surface.

^c Measured on case perimeter at junction with seating surface.

OPERATING CONSIDERATIONS

The forward current through the 40428 should be chosen so that at the reference ambient temperature the zero-signal collector current of the associated transistor or transistors has the desired value. The 40428 will then maintain the zero-signal collector current essentially constant with variations in temperature or supply voltage.



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Electronic Components and Devices Harrison, N. J.

DATA 1
6-66

To provide most effective stabilization of transistor idling current, the 40428 should be attached to the same heat sink as that used for the associated output transistor or transistors. This arrangement will provide the best possible thermal tracking. The 40428 may be attached to the heat sink by means of a simple clip such as RCA-SA2100, see *Detail Drawing of RCA-SA-2100 Heat-Sink Attachment Clip*.

To prevent premature clipping in an amplifier stage using the 40428, the circuit must be designed to assure that the 40428 is operated under forward-bias conditions at all times. This requirement may be met either by (a) making the dc forward current through the 40428 greater than the peak base current of the associated output transistor (or one of the associated output transistors), or (b) providing a separate source of driving current for the transistor. Such a source is provided in the circuit shown in *Schematic Diagram of 25-Watt High-Quality Power Amplifier* using 40421, 40329, and 2N3241 transistors, and 40428 compensating diodes by resistors R12 and R13. These resistors provide driving current to the output transistors during intervals when the peak current through R10 or R11 is below the required value.

The *flexible leads* of the 40428 are usually soldered to the circuit elements. Soldering of the leads may be done to within 1/32 inch of the glass stem provided care is taken to conduct excessive heat away from the lead seals. Otherwise, the heat of the soldering operation may crack the glass seals of the leads and damage the diode.

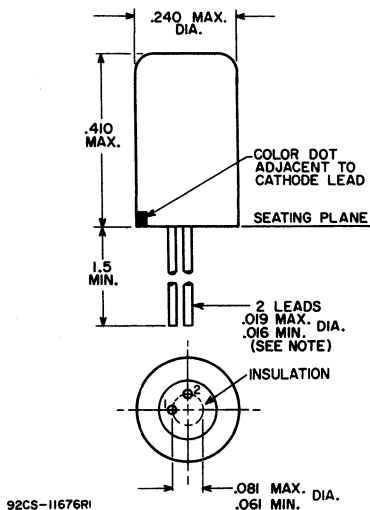
The 40428 should not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the diode or the associated circuits.

When dip soldering is employed in the assembly of printed circuits using the 40428 the temperature of the solder should not exceed 255°C for a maximum immersion period of 10 seconds.

**Schematic Diagram of 25-Watt High-Quality Power Amplifier
shown under type 40421 also applies to type 40428**



DIMENSIONAL OUTLINE

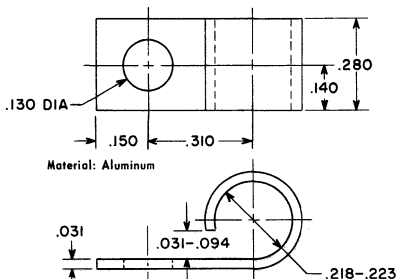


DIMENSIONS IN INCHES

Note 1: The specified lead diameter applies in the zone between 0.050 inch and 0.250 inch from the base seat. Between 0.250 inch and 1.50 inch a maximum of 0.21 inch diameter is held.

Note 2: Forward (easy) current flow through the device is in the direction toward the lead adjacent to the polarity mark.

DETAIL DRAWING OF RCA-SA-2100 HEAT-SINK ATTACHMENT CLIP



DIMENSIONS IN INCHES

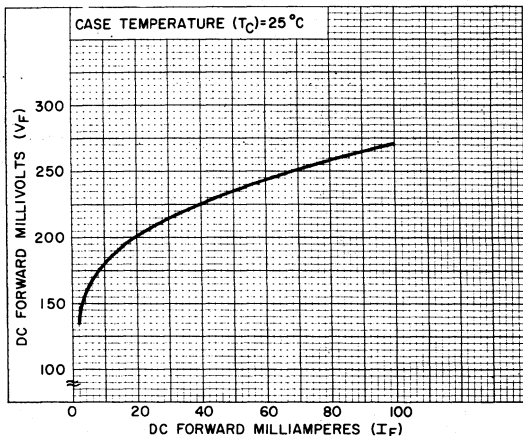


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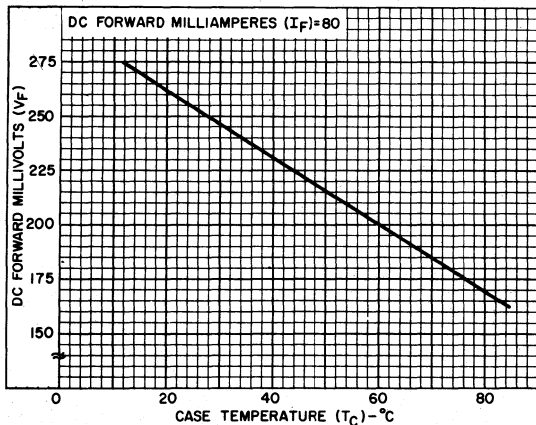
DATA 2
 6-66

Typical Forward Characteristic



92CS-13926

Forward Voltage vs. Temperature



92CS-13925



Alpha-Cutoff Frequency

for dc collector

volts = -6, dc col-

lector ma. = -1 . . . f_{ab}

4

12

-

Mc

Output Capacitance for

dc collector volts

= -6, dc emitter cur-

rent = 0 C_{ob}

-

15

20

μf

Input Capacitance for

dc emitter volts =

-6, dc collector

current = 0 C_{ib}

-

10

20

μf

Stored Base Charge

for dc collector ma.

= 10, dc base ma.

= 1 Q_s

-

1000

1400 $\mu\text{coulombs}$

PERFORMANCE TESTS

This transistor type is tested in strict accordance with rigid procedures conforming with the mechanical, environmental and life requirements of Military Specification MIL-S-19500B.

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The *flexible leads* of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the glass seals of the leads and damage the transistor.

This transistor is intended for use in socketed, single-side printed circuit boards and in conventional wire-in type circuits. If this transistor is used in double-side printed-circuit boards or in printed-circuit boards utilizing eyelets, it may be necessary to use an insulating washer or similar standoff device made of good dielectric material to prevent the solder from shorting the leads to each other or to the board.

**FOR ADDITIONAL INFORMATION ON THIS TYPE,
WRITE FOR TECHNICAL BULLETIN AVAILABLE
FROM:**

Commercial Engineering
Semiconductor & Materials Division
RCA
Somerville, New Jersey



RADIO CORPORATION OF AMERICA

Semiconductor & Materials Division

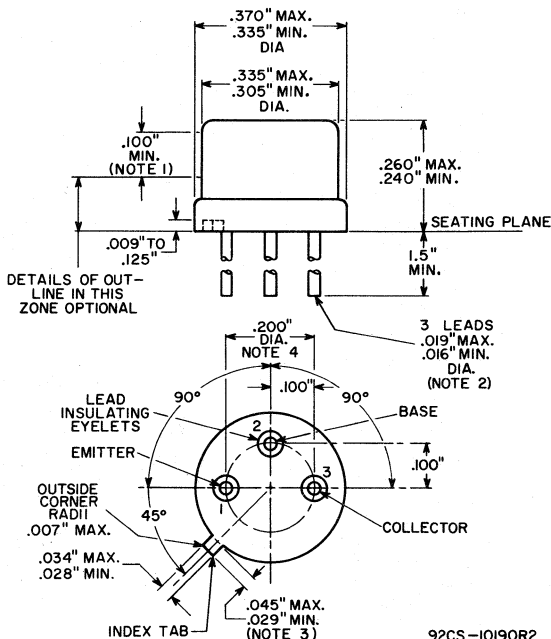
Somerville, N. J.

DATA 2

8-61

3907/2N404

JEDEC No. TO-5



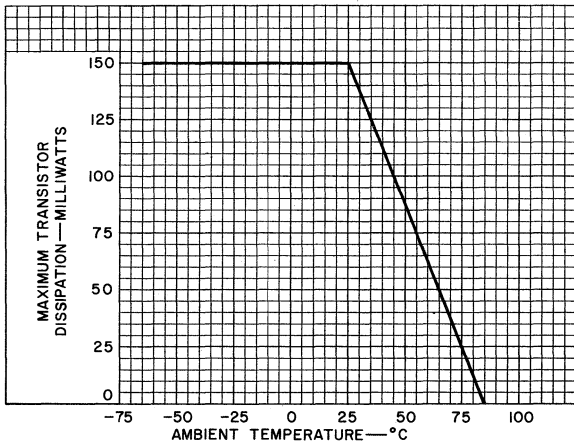
NOTE 1: THIS ZONE IS CONTROLLED FOR AUTOMATIC HANDLING. THE VARIATION IN ACTUAL DIAMETER WITHIN THE ZONE SHALL NOT EXCEED 0.010".

NOTE 2: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE SEATING PLANE. BETWEEN 0.25" AND 1.5" A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.

NOTE 3: MEASURED FROM MAXIMUM DIAMETER OF THE ACTUAL DEVICE.

NOTE 4: LEADS HAVING MAXIMUM DIAMETER (0.019") MEASURED IN GAUGING PLANE 0.054" + 0.001" - 0.000" BELOW THE SEATING PLANE OF THE DEVICE SHALL BE WITHIN 0.007" OF THEIR TRUE LOCATIONS RELATIVE TO A MAXIMUM-WIDTH TAB.

RATING CHART



92CS-10907RI



